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VIEWS, NEWS AND INTERVIEWS.

"By the way," said the man with the bulging forehead, "has it occurred to you that there is a great deal of energy lost on the New York and Brooklyn Bridge? I mean in the deflection of the bridge, owing to the weight of the passengers and vehicles traveling across it. I am now at work on a scheme to conserve this energy in some simple way. When a line of heavy trucks crosses the roadway of the bridge it is deflected to a considerable extent. I am thinking of working out a plan by which a stiff non-deflectible arch may be attached to the face of each tower, just beneath the roadway of the present bridge. On the top of this arch will be placed pistons, and the piston rods will be attached to the present bridge structure. At either end of the bridge will be placed reservoirs, and when the bridge is deflected, the pistons will descend and compress the air in the cylinders, which will be conveyed by pipes to the reservoirs and there stored. This air in the reservoirs will be used to operate air motors, which in turn will drive dynamos, to which they will be directly connected. By this means I am sure enough current can be generated to light the bridge. This idea of mine, which is a really wonderful one, opens up vast possibilities in many directions. Of course, it can be applied to any long bridge, and beside that can be used on the elevated roads, which are deflected to a certain extent, especially during the passage of express trains. My dear sir, there are millions in it, and"—just at this point the printer's boy came into the ELECTRICAL REVIEW office with proof to be read, and the poor, overworked man, to whom the man with the bulging forehead was talking, lost the balance of his remarks.

City Electrician Ellicott has discovered that the underground pipes in Chicago's streets are suffering from electrolysis, due to escaping currents from the electric railway lines. It is stated that the local railway companies will be called upon for something like $200,000 to remedy the trouble. Out of 150 tests of water and gas-pipes made, there were found but a few cases where the pipes had not been affected by electrolysis.

The Western Electric Company, of Chicago, have provided two large rooms for the girls employed in their factory. These girls have formed a club called the Occident Club, which has now been in existence for two years. It is self-supporting, and entirely managed by the girls themselves. They have fitted up the rooms, which have been furnished them by the company, one as a library and reading-room, which is also used as a room for concerts, and has a seating capacity of about 500, the other, which is of the same size, has been fitted up with lunch counters and a kitchen. On Saturday, the 16th, the Occident Club gave a literary and musical entertainment from 4.30 to 5.30, and from 5.30 to 6.30 furnished refreshments to those who cared to stay. The balance of the evening was spent in a social way. Over 400 attended the entertainment.

Passengers on a Staten Island trolley car had a great coast down a hill about three miles from St. George one evening recently. The trolley pole slipped off the wire, and the brakes did not work. A car coming the other way got on to a siding just in time to avoid a collision. The ride on the runaway car was a very exciting one, but did not result in disaster, although the escape was very narrow. A man who was on the car said that the sensation was very much like a combination of coasting on a bicycle and falling in an elevator.

ALBION E. LANG, OF TOLEDO, OHIO, PRESIDENT AMERICAN STREET RAILWAY ASSOCIATION.

STREET RAILWAY MEN.

Concluding Days of the Niagara Falls Convention.

AN ATTENDANCE OF PROBABLY 1,000 AND AN EXHIBIT NEVER BEFORE SURPASSED—SEVERAL PAPERS OF PARTICULAR INTEREST, NOTABLY ON STORAGE BATTERIES AND USE OF ELECTRICITY ON STEAM ROADS—MR. ALBION E. LANG ELECTED PRESIDENT AND BOSTON SELECTED AS THE NEXT MEETING PLACE — THE FINAL PROCEEDINGS AND ADDITIONAL NOTES OF INTEREST.

The concluding days of the sixteenth convention of the American Street Railway Association at Niagara Falls last week were as full of interest and animation as the records presented in the ELECTRICAL REVIEW in its last issue showed at the beginning. President McCulloch kept things moving with the speed of a charge of cavalry that at times suggested the rushing soldier that he was years ago, and while every question received attention there was no lagging at any time.

The reception accorded the ELECTRICAL REVIEW, which arrived Wednesday morning with a report up to that hour and an illustrated description of the hall and exhibits, was most cordial and complimentary. No journal, it is safe to say in all modesty, was more popular at any convention of electrical interests, and the officers of the association and delegates were constant in their expressions of appreciation.

In the report of the concluding days which follows, it will be noted that the chief discussion centered around the use of storage batteries as an adjunct and money saver in all power stations, and on the adoption

of electric power by steam roads, the former of special interest to the operators of the electric roads, and the latter more especially of interest to all electrical manufacturers.

At Wednesday's session, after the announcement of new members and the report of the auditing committee, a paper on "Application of the Storage Battery to Electric Traction" was read by Charles Hewitt, electrical engineer Union Traction Company, Philadelphia, Pa. It is published on page 208 of this issue.

The President: You have heard Mr. Hewitt's paper. We would like to have it fully discussed.

Mr. McCormack, of Brooklyn: Mr. Hewitt, I understood, stated that there were two cities in the United States where a car storage battery would be applicable. I would ask what cities he referred to?

Mr. Hewitt: I have in mind the cities of New York and Washington. There may be other cities which would like to have that system, but these are the only two which are seriously considering the matter.

Mr. MacFaden, of Chester: Do you recommend the storage battery in conjunction with the booster in smaller stations, or the booster itself; say, with a capacity of 900 amperes?

Mr. Hewitt: From my observation I believe that all small stations would be benefited in a large measure in their economy, if they had a storage battery. Of course, the question of investment must be considered in all these cases; but as a general principle, the operation of the station would be economized, if the battery can be used as an auxiliary.

Mr. MacFaden: What is the difference in cost between the kilowatt output of the booster, independent of the battery?

Mr. Hewitt: The only case in which I have had personal experience is the one in Philadelphia. I assume the output of the booster to be the same as the general output of the station. We do not keep separate records of the cost of it, and it would be impossible to do so. The steam furnished for the battery engines is from the same source as the steam furnished for the other engines, and we could not separate them; but I have taken the cost of the station for the months described, and assumed that was the pro rata cost of the kilowatt hour generated by the booster.

Mr. Harrington, of Camden: I ask Mr. Hewitt if the manufacturers of the battery installation have guaranteed the depreciation, and, if so, what the guarantee is?

Mr. Hewitt: The storage battery people will guarantee the depreciation, and they have guaranteed the depreciation in our case. I believe it is for five or ten years, and at a certain rate pro rata to the cost of the battery. I do not feel at liberty to say just what the figure is. I do not think, however, that there is any special secret about it. Any man who wants to purchase a battery will get the information from a battery company.

Mr. Patterson, of Salt Lake City: Mr. President, I am very much interested in Mr. Hewitt's paper. It brings out some things that I have been thinking of along on this same line. We in Salt Lake City have a steam plant as well as a water-power plant, and we are now running our system by water-power 18 miles from the city. We have occasionally, not often, been caused to shut down—once from a snow slide, which swept away the channel which we had around the mountain, and once from losing a bucket off the wheel. We still have our steam plant kept in good running order, but it takes from an hour to an hour and a half to steam up when these things occur. I was thinking, when listening to the paper being read, that it might be possible that we could operate a storage battery in connection with our plants. I would like to ask Mr. Hewitt if, in his opinion, we can have a storage battery, and if it would be a plausible scheme to turn the current after shutting down (we are at present, on average days, not counting the big days, running from 300 to 500 amperes), and run the plant by a battery; and, if so, at which end of the plant would it be best to put the battery? I presume, of course, at the transformer end.

Mr. Hewitt: I think I am right in saying that the transmission referred to by the gentleman is an alternating-current transmission, and there are difficulties in working a storage battery in conjunction with an alternating current. For that reason, it would be impracticable to put the battery at the generating end. To put it at the steam plant end, which I presume is in the city, is simply a question of dollars and cents. A battery can be bought large enough to run any road in the United States, if you want to pay for it. It takes a pretty large battery to run the road, independent of all other sources, but it is simply a question of dollars and cents entirely. In using the battery, in conjunction with other sources of power, as I have explained in the paper, you take up simply the fluctuations, and let the station do the main work; but to have a battery installation large enough to do the entire work, and make up the fluctuations as well, you would find it necessary to have a pretty large battery for any ordinary road, but it can be done, if you want to buy it.

Mr. McFaden: Would you consider it economical to have a booster and storage battery combined, as a booster line, where you would only want the power at certain times, during heavy loads and on heavy grades? The reason I ask is that we have a booster and only use it as required, and we have very good results, using it without any storage battery at all. I do not know about the economy. Would it be better to have the battery in conjunction with the booster for such work, or turn the generator into a booster? We can use it either way, as required. If we do not use it as a booster, we can run it as a generator.

Mr. Hewitt: In the case referred to at Chester, I do not think the battery would add to their economy. The battery, as a potential regulator on the end of a long line, becomes useful when the variations are so great that, in case of a sudden stopping of the cars, the potential would go so high as to do damage. For instance, at Chestnut Hill, on our plant there, we at times have the booster as high as 250 volts, above the usual 550 volts, making 800 volts in all. If the cars should be stopped or blocked at any point, the potential would go very high, and become dangerous, and blow out the lights in the lamps, and cause damage to controllers, and other consequences would be sure to follow. The battery prevents the pressure going up in such cases. In the case the gentleman has spoken of, where the potential does not have to be boosted so high as to be dangerous, and is only boosted at times of heavy load, when the potential on the end of the line is within safe limits, I do not think it would be economical to use a battery. The local conditions of every case must be considered in all such installations.

Mr. Mundy, of Lowell: I desire to ask about the application of the battery, particularly in suburban work, such, for instance, as race-track travel, without the use of the booster. If the battery were mounted in cars, would it be practicable to run these cars out, in cases of special loads, to the end of the route, when you will have the load, and then, during the race or anything of that sort, the battery would be charged from your line, and at the instant of starting of the cars, pulling off at the same time the battery, and discharging back into the line, to carry you over the heavy peak? What do you think of the application of that? You could use that same battery, in times of long waits of that kind, by having a side-track at the station, and run it in to act as an auxiliary at the station.

Mr. Hewitt: That is one of the variations of the scheme used abroad, which is perfectly possible. It is a matter, of course, on which an opinion could hardly be given in an off-hand way such as this. It would have to be considered entirely with a view to the local conditions. The cost of the battery would have to be considered against the cost of putting up the necessary line work; and running cars under these conditions and the cost of maintaining the batteries would have to be considered as against the cost of running the cars in the other way. It might in some cases prove valuable, and it might in other cases prove very costly. I could not give an off-hand opinion or estimate at the present time.

Mr. Mundy: Which do you consider would be the most economical—the use of the battery or the use of the booster?

Mr. Hewitt: I am hardly prepared to give a judgment in an off-hand way in a case like that.

Mr. H. H. Littell, of Buffalo: This is the most important question, as far as dollars and cents are concerned, that has been brought before this meeting—the question of saving money. The gentleman talks of a saving of $33,000. It has been shown to us that we can save $75,000 yearly in our operation by the use of the storage battery, and I am almost lead to believe that we can do it, but we have not made any contracts yet. I believe we ought to hear from all of the storage battery men. They have not asked me to make this request, and I have not talked with them on the subject. I believe we should give them an opportunity to say what they have to say. I ask that unanimous consent be given to the various representatives of the storage batteries to state the merits of their respective batteries.

President McCulloch put the question asking unanimous consent to have the representatives of the storage battery companies address the meeting; but as objection was raised by some of the members that the time of the convention would not permit this, the matter was not acted upon affirmatively.

Mr. Mundy: I ask the question if it is practicable to construct these batteries so that you could handle them on cars without drawing the liquid from the cells?

Mr. H. H. Littell: That shows the necessity of hearing from the battery men. The battery Mr. Hewitt described does not go on the cars, and is not supposed to be put on the cars. It is an accumulator.

Mr. Mundy: I mean with reference to what I said a few minutes since, using it at the end of the line, if it could be handled in a car of that kind to stand jolting without spilling the cells?

Mr. Wilson, of Sioux City: During the last few years a number of the smaller plants throughout the country—those which are operating a load from 300 to 1,000 amperes—have installed direct-connected units, a great many of them using compound engines. As Mr. Hewitt stated, these engines run at their highest efficiency only through a small range of the load. Now, in these smaller plants these engines run at very light load the most of the time. Mr. Hewitt spoke, briefly I thought, of the application of storage batteries to stations for load regulation. I would ask him if he can say anything further on that point, and give some idea of what saving could be effected in stations of the size I have mentioned.

Mr. Hewitt: I spoke briefly on that subject because there has been so little done in that line. If I had gone any further it would have been in the line of argument only, and I wanted to keep as close to the facts as possible. In the case at Easton it required four engines to run their cars. At the present time they run with three engines. That of itself shows that these three engines will run more economically than the four in the previous case, the number of cars remaining the same. The difference will be between the economy of an engine running at approximately its maximum economy and an engine

running at a low economy. Just what the difference is at Easton I do not know, because I was unable to get the exact data, but it would probably be a difference of 25 per cent in the coal. If an engine is running at a low economy, with five or six pounds of coal, at a low average load, and you increase the load to its maximum economy, you can probably reduce the coal per horse-power hour output down to 20 or 25 per cent; but, in addition to that, you must deduct the loss in the battery itself, so that the net saving would possibly be 20 per cent or thereabouts. I do not wish to quote that as an authority, because I have not the facts.

Mr. Harrington, of Camden: I would inquire if there is any person present who has had experience in the question which has been raised as to the matter of percentage of efficiency between running with or without the storage battery. It has been raised in our particular case, and just that one question is the hinging point, I think, more than anything else, to decide the question with us—just what saving would be effected, what the percentage would be. Mr. Hewitt thinks it would be about 20 per cent. If any of the Easton people are here they would probably know.

The President: Is there any gentleman here who has had experience so that he can answer this question?

Mr. Ely, of Niagara Falls: I agree with Mr. Littell that this is probably the most important question coming before us, as it means, if successful, the saving of thousands of dollars, to say nothing of the cents. We are taking power for the Buffalo & Niagara Falls Railway, and the other street railways of Buffalo as well, from these large generating companies—the Niagara Falls Power Company and the Niagara Falls Hydraulic Power and Manufacturing Company. They generate the power and sell it to the street railway companies at so much per electrical horse-power per annum. You will see at a glance that the street railway company has to pay for that power, whether it is used or not, and for eight hours of the day, on an average, but a small quantity of the power will be used, and for a certain number of hours, on our line particularly, for four or five hours no power whatever is being used; but we are paying all the time the fixed ratio for the entire amount of power. If the accumulator could be used to store the current, and we could use it at times when we might not take it from the power companies direct, it would be a saving to our companies of thousands of dollars per annum. In Mr. Littell's case it would be a great saving. His company is taking 1,000 horse-power daily, per annum, from this transmission line, and they are going to take more. Mr. Hewitt, in your judgment, as the result of your investigation, has the state of the art advanced to that degree that storage batteries or accumulators may now be safely, practicably and economically installed to meet such cases?

Mr. Hewitt: Yes, sir; I think the batteries can undoubtedly be installed in such cases with economy. It is merely a question of size. If you install a battery powerful enough to do the work, it will do it well and reliably. The trouble in most cases has been an overrating of the batteries. The batteries are expensive, and in most cases the railroad companies have been afraid to buy a battery large enough to do the work well. If you buy a battery which is

EXHIBIT OF THE GENERAL ELECTRIC COMPANY AT THE NIAGARA FALLS CONVENTION OF THE AMERICAN STREET RAILWAY ASSOCIATION.

too small, it will go to pieces. If you pay enough money to get one that will last you for years, it will do the work well and will be a valuable auxiliary. Whether it will be a saving to any considerable extent, in this particular case, I could not say off-hand. It could be figured out, and possibly effect a considerable saving. From what you have said, I can see that if you are paying for a 24-hour day, and you could accumulate a certain amount of power in an accumulator, you might reduce the amount of power which you are paying for; in other words, if you are paying for 1,000 horse-power hours, you might reduce it at the end of your present contract to a lower amount, and use your power then the whole 24 hours. That is a possibility; whether it would save you money, I would not wish to say off-hand. It would have to be considered; the expense of the battery, maintenance and such things would have to be figured out. As far as the physical possibilities go, it is perfectly feasible.

Mr. Dyer, of Augusta: I offer a resolution of thanks to Mr. Hewitt for this very able paper. It is certainly one we have all been much interested in, and we are under many compliments to Mr. Hewitt. I also move that the paper be received and spread upon the minutes. Carried.

Inquiry was made where the representatives of the storage battery could be interviewed, and Mr. Lloyd, of the Electric Storage Battery Company, invited all who were interested to call at his company's exhibit or at their parlors at the International Hotel.

The President: The next paper is on "Power Distribution and Use of Multiphase Current Transmission for Ordinary Street Railways," by Mr. Maurice Hoopes, electrical engineer Lynn & Boston Railroad Company, Lynn, Mass. Mr. Sergeant says that Mr. Hoopes intended to be here and read his paper and answer questions, but has been compelled to abandon his work and go away for recuperation, and as he is unable to be here the secretary will read the paper.

It was read and a vote of thanks passed.

The President: The next business is the appointment of the Nominating Committee to nominate officers and select the place for the next meeting. If there are any gentlemen who desire that the next meeting should be held in their respective cities, we should be glad to hear from them. I will appoint as the Nominating Committee, Mr. H. M. Watson, Buffalo, chairman; Mr. George B. Kerper, Dayton; Mr. Ernest Woodruff, Atlanta; Mr. W. Worth Bean, St. Joseph; Mr. Albert T. Potter, Providence; Mr. John A. Rigg, Reading; Mr. D. S. Goodrich, Hartford.

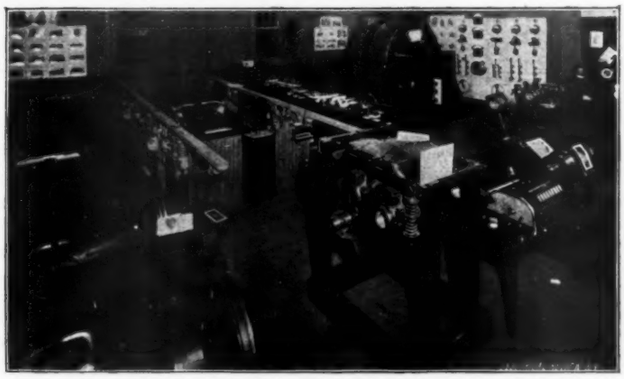

EXHIBIT OF THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY AT THE NIAGARA FALLS CONVENTION OF THE AMERICAN STREET RAILWAY ASSOCIATION.

Mr. N. H. Davis, of Cincinnati, presented an invitation on behalf of the city. Mr. Graham, of Boston, followed with an invitation for Boston, and Mr. Taylor, of Omaha, presented the claim of that city.

The meeting then adjourned until Thursday morning.

THURSDAY'S SESSION.

President McCulloch called the meeting to order at 11 A. M., and the secretary read a letter from Mr. H. H. Vreeland, of New York, and a telegram from Mr. Thomas H. McLean, of Mexico, regretting their inability to be present at the meeting.

Mr. H. H. Littell, of the Buffalo Railway Company, invited the delegates to visit the power-houses of that company.

President McCulloch advised all present to visit the Buffalo power station.

Mr. Bacon, of Ford & Bacon, New York, presented the report of the National Conference on Standard Rules, which advised the association to formally affirm the "National Electric Code." Carried.

On motion, it was voted to approve the amendment, leaving it to the executive committee to select the date of meeting hereafter, said convention to be held between the dates of September 15 and December 15.

A welcome was extended to the representatives of the Accountants Association, and Mr. Chas. N. Duffy, the first vice-president, thanked the convention for its welcome, saying:

The Street Railway Accountants Association was organized in Cleveland, March 23-24, of this year. The accounting department of street railways are very diversified. It is largely the result of the ideas of the men in charge, or the conditions under which the road is operated, and we feel that it is wise for us to have a convention and better our work and learn from one another, just as you operating gentlemen have done in this convention, and that is our purpose—to acquire information from one another and interchange ideas, and to bring out the good points of all systems of accounting, for the common good; also to attend these conventions and profit by the exhibits and other advantages which you gentlemen enjoy. We desire, if possible, to promote a simple, wise and elastic system of accounting, which will be economical and uniform, so that, as far as possible, all street railway accounts shall all be on the same basis.

The committee on rules of governing motormen and conductors reported, and report was accepted and committee continued for another year.

The question of rates charged for carrying mail on street cars was discussed at length. It was shown that there was quite a diversity of charges. It was decided to refer the question to the incoming executive committee.

A paper on "Discipline of Employés," by Mr. George H. Davis, superintendent of the Canal and Claiborne Railroad Company, New Orleans, was read, and a vote of thanks extended to the author.

The next paper was by Col. H. N. Heft. It appears elsewhere, and the discussion in full will be published in the REVIEW next week.

(Concluded on page 206.)

General Electric Company's Surface Contact Street Railway System.

The introduction of a commercial electric traction system, involving the principle of surface contact, while eliminating the distinguishing features of the overhead and underground contact systems, is an event which street railway men have long been expecting, and which is now an accomplished fact. Experiments, stretching over many months, have been carried on continuously at Schenectady, N. Y., and the occasion of the visit of Lord Kelvin was taken advantage of by the General Electric Company to make public their successful outcome.

The demand for a commercially practical system of surface contact electric traction has existed since electric traction was first introduced, but such a system had to come to its appointed place after the overhead and underground contact systems. Various schemes have been evolved in the past which have either been discarded as impracticable or have appeared before the demand for them had become acute enough to encourage their development. To-day the demand for a surface contact system exists, and, peculiarly enough, this demand comes from Europe. In an European city the first practical surface contact electric railway is already far advanced toward completion.

The experiments at Schenectady have been carried out upon a stretch of the track which forms part of the extensive factory tramway system of the General Electric Company's works. As the illustration shows, the addition to the roadbed between the rails of the track consists simply in two parallel rows of iron disks, convexed to a height of about one inch above the level of the rail. The car shown in the illustration is a simple factory tramway, to which the controller, motor and storage battery equipment have been fitted. It may be said here that the General Electric Company is now engaged in changing over to the surface contact system the entire trolley tramway system in its yards.

The main requirements in a surface contact system are four: Low cost of installation and maintenance; absolute absence of current from all disks not covered by the car; freedom from leakage of current, and reliability under all possible conditions of weather, service and location. It is the attempt to meet simultaneously all these requirements that has rendered the problem one of considerable difficulty, demanding long study and costly experiment to overcome.

In the General Electric surface contact system it is claimed that the requirements are adequately complied with, and, from the description which follows, this will probably be admitted.

The only live portions of the General Electric surface contact system on the street surface are the contact plates immediately beneath the car. This is true whatever the position of the car and whatever the speed—each plate in turn communicating current to the motors and becoming inert as the contact shoe on the car leaves its surface. These contact plates are placed in parallel rows between the two rails of the track and are set alternately. In the illustration, the positive or communicating disks are on the right, the negative or discharging disks are on the left, one of each between two of the others. Each positive contact plate is made alive by the operation of an automatic magnetic switch, which, instead of being placed in immediate juxtaposition with its plate or opposite it outside the track, is placed in a manhole with a large number of others, each connected to its own respective plate. Through each negative plate is performed the double duty of closing the contact in the switch which "cuts in" the positive plate and of receiving the return current from the motors. Fig. 2 shows the arrangement of the plates on the street surface.

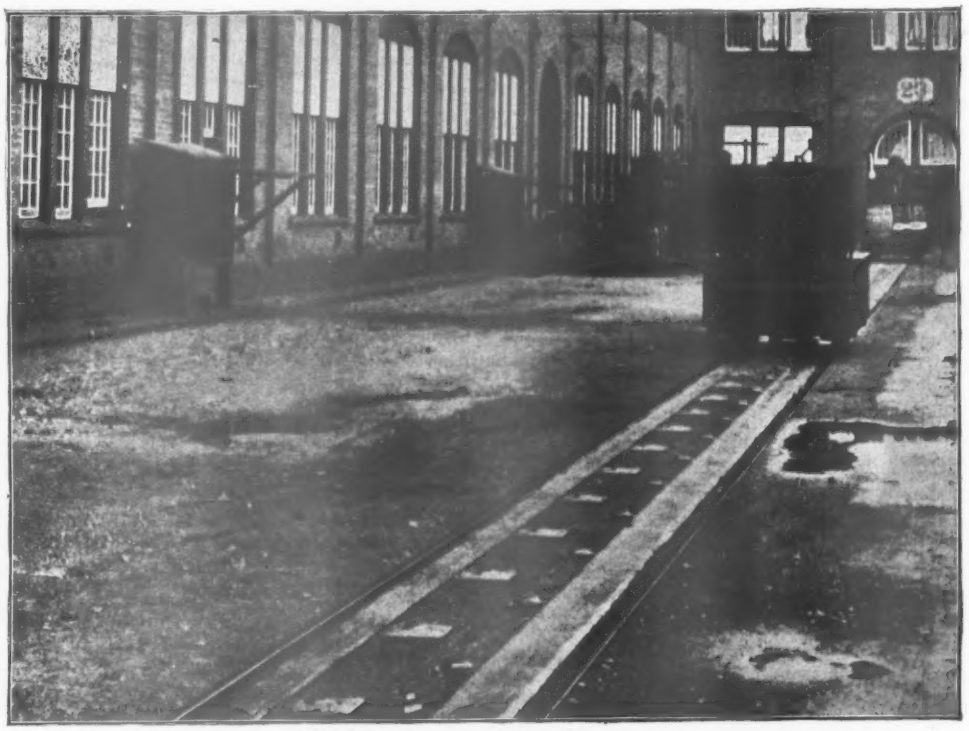

FIG. 1.—G. E. SURFACE CONTACT SYSTEM, SHOWING STRETCH OF TRACK IN YARDS OF GENERAL ELECTRIC COMPANY'S WORKS AT SCHENECTADY, N. Y.

The operation of this system will be understood from the diagram Fig. 3, A′ A″ and the negative plates B, B′ and B″ the positive contact plates, placed equal distances apart, a little less than one-half the over all length of the shoe.

C, C′ C″ represent the automatic magnetic switches and D, D′ and D″ their armature or contact makers. F is the positive or collecting shoe, E the negative or return shoe, and C the track return. H and K are switches which form part of the controller, the latter connecting in, or cutting out, the cells of a small storage battery, which is used only to energize the coil of the first switch through the plate over which the car passes in starting. After the armature of the first switch has been raised into contact and the line current has completed its circuit, the battery is cut out by the forward movement of the controller handle. In the diagram the car is to move to the right and all the magnetic switches are open. The handle of the controller is turned to the first notch, and switches H and K are closed. Current from the battery flows through a small portion of the motor resistance to the shoe, thence to contact plate A, and the coil C″ completing the circuit to the ground. The coil C′, thus energized, raises the armature D′, closes the circuit through the automatic switch and the line circuit completes its path through the motors and through the greater part of the motor starting resistance shown by the arrows through the positive plate B and shoe F. Part of the return circuit goes to the storage cells, which are kept constantly charged, and part through shoe E, negative contact plate A′ and coil C″ to ground, keeping the latter energized and the automatic switch closed so long as the shoe remains on contact plate A′. Moving the controller handle forward from the first notch to the second notch opens the switch K, cuts out the battery and sends all the return current through the coil C′. The shoes E and F in the diagram are a little longer than the distance between contact plates. Thus, when the car moves forward slightly, the shoe will be in contact with the two contact plates A and A′, and the return circuit will divide, half going through coil C″ and half through coil C, energizing both, and closing the armatures in the switches D′ and D. The car moves forward and the shoe passes beyond the contact plate A′. The circuit in the coil C′ is broken, the armature D″ drops, cutting out entirely positive plate B″, leaving it dead, but allowing B′ still to receive current through the closed switch at D. Shoe F, moving forward, then makes contact with plate B before it leaves plate B′, and the current is uninterrupted in its flow.

The automatic magnetic switch is the heart of this system. It has been designed to endure under the severest strains, and to act with such uninterrupted precision that the working of the system may not be impaired. The development of this automatic magnetic switch marks a decided step forward. Mechanically, the switch is simple, strong and durable, with all chances of derangement reduced to a minimum. In the course of the experiments this switch has been subjected to the roughest possible usage and has withstood it unharmed.

If the leakage is great an arc is likely to form when the armature of the switch drops, and so long as this is held the contact plate in the street would remain alive, while the arc would burn the switch. It is not practicable to allow the armature to drop far enough to break the arc, and, to extinguish it, the magnetic blow-out principle is brought into play. By the use of this, retention of this arc is impossible. But there is also the possibility of another arc forming in case of accidental ground on one of the leads to the positive contact plate, or if the forward switch fails to close when the handle of the controller is on the first notch, giving a path to ground through the battery. This is also taken care of by the magnetic blowout. All surface contact systems have similar conditions to meet, but none have incorporated the magnetic blow-out principle.

The form of the contact plates is shown in Fig. 2. They are first set in iron boxes and then surrounded by insulation. The contact plates consist of two parts, a wearing piece screwed into a support and held by a spring washer. This wearing piece can be removed readily without disturbing the support. The standard "shoe" is 13 feet long. Its shape and suspension is shown in the sketch, Fig. 5, the ends being curved upward slightly to prevent catching. The shoes are supported from the axles

and have a slight upward and downward movement to allow for any irregularities in the height of the contact plates. The amount of drop in the shoe is regulated by a set screw.

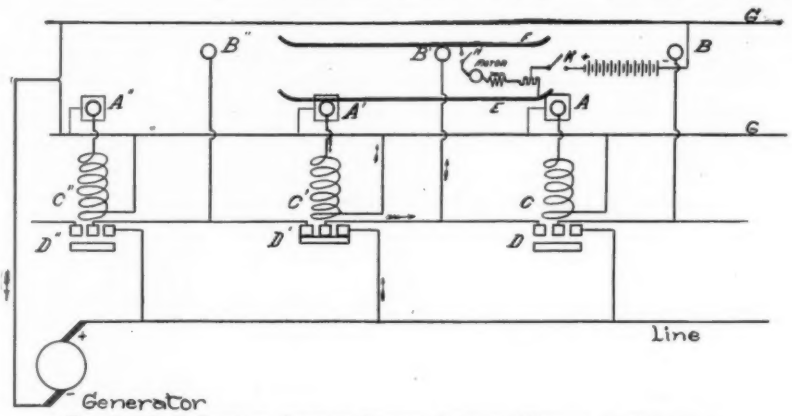

FIG. 2.—G. E. SURFACE CONTACT SYSTEM, SHOWING METHOD OF OPERATION.

The automatic magnetic switches are grouped in manholes, where inspection can readily be effected. Fig. 4 shows a group of those temporarily arranged for exhibition. Each manhole will contain about 20 switches, and the wires from the contact plates to them will be protected in similar manner to underground wires for any other purpose.

The battery on a car consists of 10 cells, with normal capacity of 50 ampere hours at five amperes. It is equal to all emergencies, being called into requisition only momentarily while being charged, the balance of the time the controller handle is on the first notch.

A close examination of the design and operation of this system will show that it possesses many striking advantages. The operation of the automatic switches is perfect under all conditions, as the full line voltage can be secured to close them, and they open by gravity. There is no possible chance of the contact remaining electrified after the car has passed, as by the use of the blow-out on the switch and the switch itself, which opens as soon as the current is shut off, all danger and trouble due to live contacts is eliminated.

Grouping the switches in manholes renders the working part of the system easily accessible for inspection.

In the city of Monte Carlo, in the principality of Monaco, this system is being laid down by the Compagnie Française Thomson-Houston over a distance of about three miles. It is expected that this will be in operation very shortly.

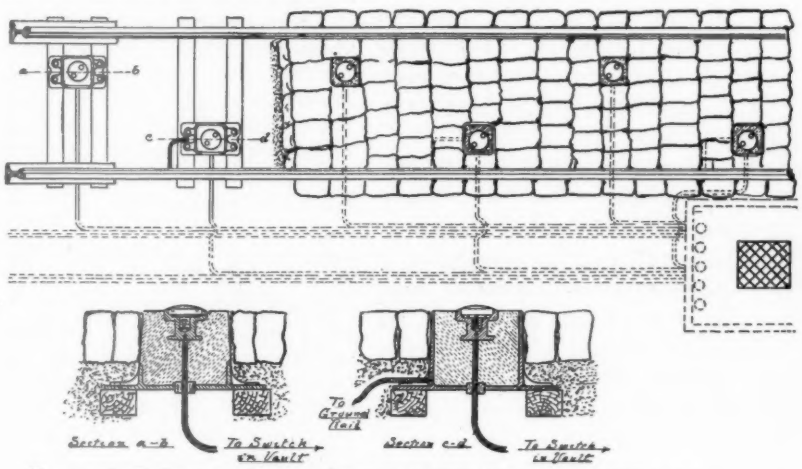

FIG. 3.—G. E. SURFACE CONTACT SYSTEM, SHOWING SURFACE OF STREET AND SECTIONS THROUGH POSITIVE AND NEGATIVE PLATES.

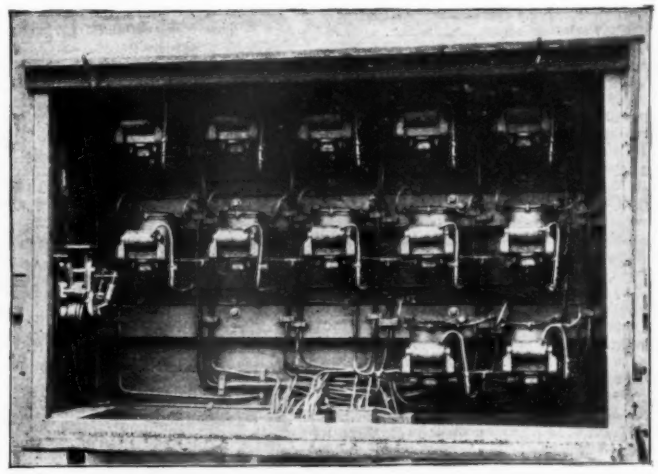

FIG. 4.—G. E. SURFACE CONTACT SYSTEM, SHOWING AUTOMATIC MAGNETIC SWITCHES IN TEMPORARY MANHOLE.

OUR CANADIAN LETTER.

NELSON, B. C.—The electric light company has made an offer to the town to light the streets, which will shortly be considered.

CARLTON PLACE, ONT.—The proposal of an electric railway from this place to Lanark is still being considered. The promoter is a Mr. Fowler.

MAGOG, QUE.—A special committee of the Town Council has reported in favor of borrowing $10,000 to purchase an electric light plant and develop water-power.

LANARK, ONT.—The ratepayers of Lanark have recently expressed themselves at a public meeting as strongly in favor of the Lanark County Electric Street Railway.

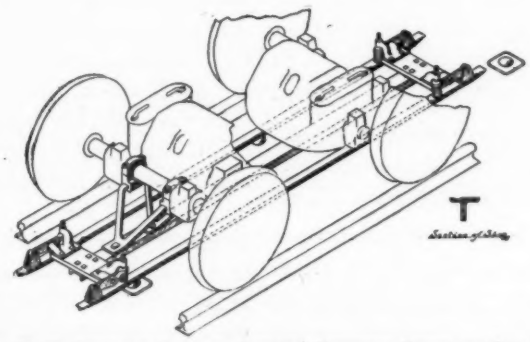

FIG. 5.—G. E. SURFACE CONTACT SYSTEM, SHOWING SHOES ON CAR TRUCK.

LONDON, ONT. — The London Street Railway and the London Township Council have come to terms, and street railway extension to Pottersburg will proceed at once.

ORANGEVILLE, ONT.—Tenders are being received by William Wallace, chairman Street Lighting Committee, for the furnishing and operating of 29 arc lamps of 1,200 candle-power each on the streets of the town of Orangeville. Estimates are solicited for one, two and three-year contract.

OTTAWA, ONT.—Abearn & Soper will build the telegraph line on the New York & Ottawa Railway from Ottawa to Moira, N. Y. It will include a cable across the St. Lawrence River.

MONTREAL, QUE. — Mr. A. J. Corriveau, the promoter of the Montreal Southern Counties Electric Railway, has recently returned from a tour through the proposed route. It is the intention to run the line through Chambly, where the necessary power shall be obtained.

HALIFAX, N. S. — The Halifax Street Railway has decided to issue an additional $250,000 to the stock. This will make the capital of the company $800,000. The new stock is to be issued to the ratepayer on record, in the proportion of one share to each four held. A quarterly dividend of one and one-fourth per cent was paid on October 1. J. A. C.

Montreal, October 20.

That Electric Light Injunction in Brooklyn, N. Y.

Capt. Noah L. Cocheu, general manager of the Amsterdam Electric Ligh, Heat and Power Company, of Brooklyn, N. Y., stated last week that no injunction had been granted by Justice Gaynor restraining his company from carrying on its business or prohibiting the State Trust Company from foreclosing a mortgage on the franchise and property of the State Electric Light Company or prohibiting him from conducting any business for either concern or prohibiting the State company from disposing of or selling any of the franchises or privileges to that company. Captain Cocheu said that no injunction whatever affecting any or either of the parties mentioned had been granted. He admitted that an application had been made to Justice Gaynor for an injunction, and that he had been served with a copy of a complaint and an order to answer. Captain Cocheu also said that the only plaintiff appearing in the complaint was not a stockholder of record in the State company, and had no right to make a complaint of any kind. The plaintiff had been at one time secretary of the State company. The Amsterdam company, according to Captain Cocheu, has settled its indebtedness to the State company to the amount of about $70,000, and the company is now furnishing lights in certain parts of Brooklyn.

Catalogues As Sales Agents.

The days of the catalogue as a sales agent in the engineering export trades appear to be numbered, says *Cassier's Magazine*. Experience has shown that, even though the catalogue or price-list be printed in the language of the country where the business is to be found, and even though it be circulated liberally, something more is necessary to actually get the business, and that something is personal representation. Men should be sent, and not catalogues—men who understand the machines and appliances which are to be sold, and particularly the people to whom they are to sell. British and American machinery builders should long ago have kept pace with the enterprising Germans in this respect instead of learning slowly by commercial disappointment that somebody had reaped the harvest ahead of them.

Electrical Review

Times Building, 41 Park Row,

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1546 "CORTLANDT," TELEPHONE CALL.

Special Notice to Advertisers.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication on the following week.

NEW YORK, OCT. 27, 1897.

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Thomas Alva Edison and his achievements are part of the world's history. Still, it is not time to write of them as a completed whole. The restless, seeking mind of this inventor is not yet content. Another great triumph, through the genius of hard work long years continued, through the sacrifice of comfort and venture of fortune—a triumph over obstacles pronounced by trusted authorities as insurmountable may now be placed to his credit. Edison's labors in the iron mountains of New Jersey and the success won are to-day told in the ELECTRICAL REVIEW. It is a story of much interest. It gives new ideas of the dogged determination and constant courage of this man of mental equipment and physical vigor, who seems unable to cease from an undertaking until success comes.

THE ELECTRIC RAILWAY CONVENTION.

The sixteenth annual convention of the American Street Railway Association, held at Niagara Falls, N. Y., last week, was attended by about 1,000 persons. The exhibition of electric railway supplies and appliances was the most complete ever held at any time, and the entertainment provided for the visitors was of a pleasant and instructive character. Looked at from any point of view, the convention was a thorough success, and its proceedings will be of undoubted benefit to the electric railway field in general.

The various sessions of the meeting were marked by a promptness quite unusual in the carrying out of a set programme. This was a valuable point appreciated by every one present, and was due chiefly to the excellent management of the association's affairs which has prevailed during the past few years. President McCulloch occupied the chair with dignity and ability, and Secretary Penington performed his many onerous tasks with promptitude and thoroughness.

The addresses made before the convention which called forth the most applause and discussion were those by Colonel Heft, on the application of electricity to existing steam roads, and that of Mr. Hewitt, on the storage battery as applied to traction purposes. Throughout the discussion it was evident that the delegates were perfectly familiar with the question in hand, the result being a valuable contribution to the knowledge on both subjects.

The newly elected president, Mr. Albion E. Lang, of Toledo, Ohio, finds on assuming office that the affairs of the association are in splendid shape, and his administration will undoubtedly be carried through with profit to the association and honor to himself. Boston has been decided upon as the next meeting place, and it was a fortunate choice, as by the time the next meeting is held there will be many features of practical value to rapid transit in that city in which every delegate will be interested. It is to be hoped that the success achieved at the sixteenth annual meeting of the American Street Railway Association will be repeated at the seventeenth convention.

It is estimated that the state of Montana will produce 250,000,000 pounds of copper during 1897. In 1882 Montana produced 9,058,284 pounds of copper; in 1892, 161,051,477 pounds, and in 1896, 228,958,164 pounds.

EDISON ORE MINES.

SUCCESS FINALLY REWARDS THE EFFORTS OF YEARS.

AN INTERVIEW WITH MR. EDISON—A DESCRIPTION OF HIS VAST WORKS AND UNIQUE PROCESSES—AN IMMENSE FORTUNE EVIDENTLY TO BE REALIZED AFTER AN EXPENDITURE OF NEARLY $3,000,000.

A TALK WITH EDISON AT HIS LABORATORY.

I was told that I might find Mr. Edison too much absorbed to take any moments from his work, as these were very busy days with him, for the development of this herculean task of electrically taking iron ore from the earth was occupying his mind, but that during these October mornings, while at Orange, he reached his laboratory at five o'clock. With this in mind I went to his laboratory something before eight o'clock, and in answer to my inquiry his representative said: "He is very late this morning, but I believe he will soon be here," and I was ushered into a large library, surrounded by tiers of upper galleries, the furnishings of which were presented to him some years ago by his employés, and where he spends many of his studious hours. The spacious galleries are filled with a wide range of books of reference and records along the lines to which his life is devoted.

After a few moments of watching I saw a figure trudging slowly along the path near the outer gate, and Mr. Edison appeared with his head inclined downward apparently in deep meditation. He was clad in a long blue frock coat, and wore on his head a light slouch hat such as is commonly seen, though this carelessly hung on his head. I could just imagine, as he crossed the large hall to greet me, that this unusual thoughtfulness was evidence that, now the question of furnishing the world's supply of iron had been solved to his satisfaction, his powerful mind was concentrating on other problems which, like this, had been pronounced unattainable.

"Yes," he said, after he had read my letter of introduction, "I believe that this piece of work is thoroughly developed. You have seen the plant, I suppose? Well, every operation and every process is now on a practical basis, and I think my work is done."

After some additional explanation, which Mr. Edison made about the deposits of iron ore in New Jersey and the scarcity of iron ore, which has been disturbing the mills of the East, he outlined the work to which he has been for nearly eight years devoted. It is simply applying on a scale of many thousands of tons a day, the principle of a magnet drawing the little black particles of ore from the pulverized rock. The obstacles to be overcome, even to a developed scientific mind, seemed insurmountable. The magnetic surveys, which were made under his direction by several corps of men, included a whole strip from lower Canada to the Great Smoky Mount-

ains of North Carolina, for the purpose of locating the best deposits of iron.

Returning to the subject of the principles involved, Mr. Edison took my pencil and said: "Let me show you the principle of the magnet operating on the iron and the refuse sand after it has been pulverized from huge rocks of many tons weight," and with this remark, made the little diagram which is here reproduced. The explanation is apparent, for as the crushed product falls from the moving belt the immense system of magnets, which are sufficiently powerful, if the total of their attractive force could be

THOMAS A. EDISON, FROM HIS FAVORITE PHOTOGRAPH.

concentrated, to lift the largest cannon, are drawn inward, and the dust or other elements not being affected by the magnetic system, keep the natural gravity and are separated.

In response to a question, Mr. Edison said that he believed that this would prove the most important work of his life, as its effects would be so far-reaching in increasing the supply of iron materially, and it was evident to the interviewer that the subject to him was a very pleasing one for discussion. The huge steam shovel, of which the company organized to carry on the work of Edison has the largest in the world, is capable of eating into a mountain like a huge gourmand, and passing the material on for refining.

The picture of Mr. Edison, herewith presented, is from a photograph made at Shamokin, Pa., 12 or 15 years ago. It is the picture by which Mr. Edison prefers to be known, as it was taken when he was in the prime of life and expresses a certain intensity and strength of character which succeeding years have tended to soften into perhaps a more gentle and benign character. When he presented the picture, on which he had put his autograph at my request, he said it had never been published.

S. H. GODDARD.

Orange, N. J., Oct. 26, 1897.

A DESCRIPTION OF EDISON'S ORE MINING PLANT.

Within 100 miles of Greater New York, Thomas A. Edison is performing a task the magnitude and simplicity of which can be appreciated only by personal investigation. Mr. Edison's apparatus is literally chewing up mountains.

Not only this, but he is utilizing a material heretofore considered absolutely useless. He is going to make a whole lot of money out of this material that no other manufacturer can afford to even consider, and he is doing it after a fashion that is practically perfectly automatic.

The old "Ogden iron mines," in the mountainous district of New Jersey, 1,500 feet above sea level and a few miles from Dover, have been worked off and on since the Revolutionary War They were never very profitable, and, along in the seventies, were to all intents and purposes abandoned. About eight years ago, Mr. Edison acquired the mines and a surrounding tract of land aggregating nearly 3,000 acres. This stretch of country is composed of mountains of magnetite, which is a low-grade iron ore, carrying on the average about 25 per cent of iron. The ore resembles gray rock in appearance, and is so soft and friable as to be unfit for building purposes or even for making roads. The iron, accompanied by considerable mica of poor quality, occurs in this rock in little flakes about the size of a pinhead.

A complete and accurate magnetic survey of the property has been made, and shows that the ore bed trends from northeast to southwest, covering an area about 12,000 feet long and from 50 to 600 feet wide. The ore averages very close to 25 per cent iron, and Mr. Edison says there are on this property 200,000,000 tons of it, or 50,000,000 tons of iron. His object in life for the past six years has been to recover this ore at a profit. He has succeeded.

But the little settlement of "Edison" is littered with the evidences of failure upon failure. On the other hand, machinery of elementary simplicity is at work ready to turn out from 1,000 to 1,500 tons of iron daily.

And Mr. Edison looks over the plant and says, "What do I care for a hundred failures, if I get there on what I'm after?"

Mr. W. S. Mallory, who is the right hand of Mr. Edison, says: "He is going to make more money out of this than he ever made or will make out of all his other inventions. Three-fourths of the New Jersey & Pennsylvania Concentrating Company are his property. We have spent about $3,000,000, nearly all of it his money."

The character of the man is shown in the fact that he is the only one of the original projectors of the scheme who, from the technical side, has stuck to the idea with never-swerving faith.

As the ore was of such low grade, the watchword from the start was economy. Mr. Edison constantly strove for automatic apparatus at every step and in every detail of his undertaking. Human hands, so far as possible, must not have anything to do with the manufacturing processes. His associates say he never was so happy as when he would "get up some rig," as they call it, and then remark, "Boys, you can let five more men go to night—don't need 'em."

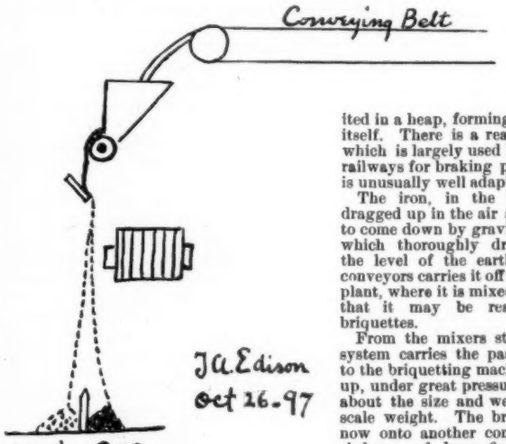
His fertility of invention is shown by the circumstance that near one of the boiler-houses is an old abandoned mine shaft 400 feet deep. This had filled up with water. Mr. Edison cast his mind on the matter, or, rather, water, and ordered a steam pump to be set up near the mine mouth. The pump has since continued to supply all the water used for steam making. The shaft fills up about as fast as the water is pumped out.

His acumen in another direction is illustrated in the fact that *he now controls all the known tracts of magnetite in the United States.* He is a landed proprietor to the extent of 16,000 acres located in New Jersey, New York and Pennsylvania. And that means in another way that he owns 4,000 acres of almost chemically pure iron. The ore at the Edison, N. J., tract alone is sufficient to produce 1,000 to 1,500 tons of iron every day for 100 years to come.

"Consider this," said Mr. Mallory, pointing to a map. "Here we have over 16,000 acres of magnetite, located near the converging corner boundaries of three states. That's the raw material near at hand. Over here in Pennsylvania, but a few miles away, we have the immense anthracite coal fields. That's our fuel, and it's so near as to be almost at the door. Below the coal fields in Pennsylvania is a great collection of blast furnaces. That's our market for our finished product. The thing is almost ideal in its surrounding conditions. The three vital elements of the iron business are located at the angles of an equilateral triangle, all within profitable shipping distance.

"Let's start at the beginning," continued Mr. Mallory to the ELECTRICAL REVIEW representative who was visiting Edison. "We'll walk up this narrow gauge track to where that big steam shovel is at work. We have about three miles of this narrow-gauge track running around and about the place, and all our ore is handled on these little cars, each just large enough to carry an iron 'skip' holding about six tons of ore. Miniature locomotives, as you see, haul the trains of cars."

By this time we had come up to a complicated-looking piece of machinery which resembled a cross between an octopus, a freight car and a machine shop. Its actions were nearly human in their diversity and exactness. The thing was a 93-ton steam shovel, the largest ever built. This fellow, with his scoopy nose, can grab three tons of ore, raise up his neck and then lower the burden into a "skip" on a car on a side track, and do it all in 10 seconds. He's a wonder. He has a little brother working further down the line, but he's only a 60 tonner.



SKETCH DRAWN BY MR. EDISON FOR THE "ELECTRICAL REVIEW" TO ILLUSTRATE THE PRINCIPLE OF MAGNETIC ORE SEPARATION.

"We tried all kinds of schemes for the quick and automatic handling of the ore—everything from cantilever cranes down, but this old chap beats 'em all. He tackled a 10-ton chunk of ore the other day and got tipped over for being so brash. But the two men who run him got him back on his track again all right and he's been very good ever since. Here comes the mine boss. He'll tell you about the blasting."

The mine boss in crisp, explosive sentences, characteristic of his calling, explained how the trees and loam are cleared off a mountain top, how a line of blast holes are drilled along one side, and how just enough forcite powder is used to break loose the mass of ore so that the big steam shovel can stick its nose in the bank, fill its scoop and then load the cars. After a train of cars is loaded, it is run down on either side of the big crushing mill.

This machine is a Titan, with a capacious maw, which will grind up a six-ton rock before you can wink twice. The distance between the two great rough toothed rolls is 14 inches. The hopper through which ore is fed to the monster is on a platform some 20 feet from the ground. On either side of this platform the skip-laden cars are brought up. Over each track is a powerful electric crane, which picks up a skip and in a trice dumps its contents into the hopper, where it disappears like a flash, crushed between the powerful jaws, ever hungry for more.

After being crushed in the big mill the ore is carried from one mill to another by means of an elaborate system of belt and bucket conveyors, either to a storehouse or to the magnet house. If to the latter, the now finely divided ore is elevated by an endless chain of buckets to the top of the building, some 100 feet high, and is allowed to drop down through a long series of electro-magnets.

A wooden partition is so arranged that the iron, attracted by the magnets, is deflected to one side, while the sand, being non-magnetic, falls by gravity to the other side of the partition.

A separate system of conveyors carries the sand off to one side, where it is deposited in a heap, forming a little mountain by itself. There is a ready sale for the sand, which is largely used by steam and electric railways for braking purposes, for which it is unusually well adapted.

The iron, in the meantime, has been dragged up in the air again and is allowed to come down by gravity through a heater, which thoroughly drys it. On reaching the level of the earth another system of conveyors carries it off to the "briquetting" plant, where it is mixed with a "binder," so that it may be readily moulded into briquettes.

From the mixers still another conveyor system carries the pasty black mass of ore to the briquetting machines, which stamp it up, under great pressure, into little biscuits about the size and weight of a one-pound scale weight. The briquettes are dropped now onto another conveyor, and are carried up and down five times while in the conveyor buckets through a furnace where they are baked. This process of baking consumes something over an hour. When the baking is completed another set of buckets carries the briquettes out of the building and lands them in waiting ore cars, which carry them to the market, where they have been sold.

And not a human hand has touched either the ore or the briquette at any stage of the process.

"What speed can you acquire throughout these many processes?"

"Counting from the ore on the skips as they stand alongside the big mill," replied Mr. Mallory, "we can dump the finished briquettes into the cars for shipment in about 130 minutes. Of this time 110 minutes are used up in the baking furnace."

"Are the briquettes hard enough to stand shipment without disintegrating?"

For reply, Mr. Mallory seized a briquette, still unbaked, and threw it against the side of the house with all his force. It had a little scar on it afterward—that was all.

"It seems as if there must be a great deal of wear and tear on your machinery, especially the mixers."

"That's where they said we'd fail," replied Mr. Mallory. "We've gone into that question most thoroughly and in our calculations we allow $14,000 a year for renewals, which we have found to be a very liberal allowance.

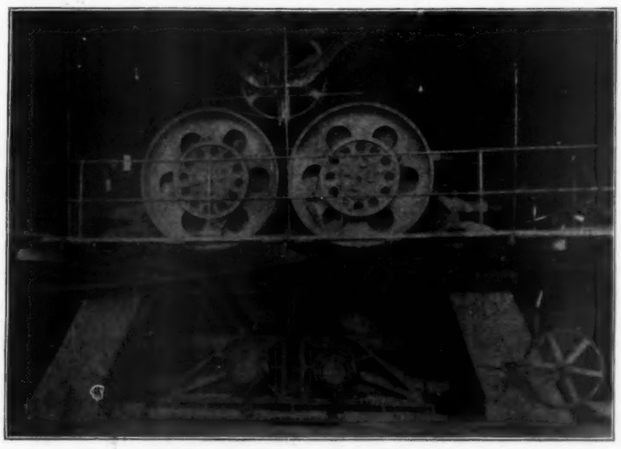
"On all our machinery," he continued, "we use 'safety pins' in the shafting. This is a device which Mr. Edison invented to correspond with the safety fuse in electric circuits. The safety pins are designed to carry the intended load and no more. For instance, in the mixing machines, if a workman should drop a wrench into the mixer, the unusual strain would at once break the safety pins before any damage could be done.

"Another interesting feature is our automatic oiling system. We lubricate between 4,000 and 5,000 bearings of all sizes by a system of piping through which the oil is pumped from a central station. The oil, as fast as used, is returned to the central station, filtered and used again. This is but one of the many economies we have in service."

The whole plant is thoroughly illuminated by electric lights, as work is frequently carried on day and night. A recently erected power-house supplies the current, steam-power for the generation of which is furnished by two 350-horse-power Morrin "Climax" boilers.

This brief sketch gives an outline of a stupendous work being carried on by a master mind, aided by loyal friends, which will be of the greatest industrial and commercial importance, not only in years to come, but within a very few months, and what has been told above is but the glimmer of success after many and tedious dark days of experiment and endeavor. Mr. Edison's faith in his undertaking and in the success of his plans is of that sublime character which places it above all doubt.

Edison, N. J., Oct. 26. S. L. C.



THE GREAT IRON-ORE CRUSHING MILL AT EDISON, N. J.

THE APPLICATION OF ELECTRICITY TO RAILROADS NOW OPERATED BY STEAM.*

BY COL. N. H. HEFT.

The New York, New Haven and Hartford Railroad Company owns and controls about 2,800 miles of main line railroad track in New York, Massachusetts, Rhode Island and Connecticut, of which about 16 miles are operated by electricity on the third-rail system and 14 miles on the overhead trolley system.

The company also owns the entire capital stock of the Stamford Street Railroad Company and the Meriden Electric Railroad Company, the former operating about 10½ miles of track, and the latter about 17½ miles on the overhead electric system.

It is through my official connection with the Meriden company that I am permitted to be present at the meeting of the American Street Railway Association, a privilege which I thoroughly appreciate.

Electric railroading on a large scale is but the development of street railway experience, and, if the future brings success in the efforts now being made to use electricity for heavy work, it will be due largely to the courage and enterprise of those who have "blazed the path of progress" and forced the fighting by entering into competition with an industry which believed itself, ten years ago, absolutely secure in its position.

There is little for me to tell you of novelty in the work done by the New Haven company in Meriden and Stamford. These are ordinary street railway systems, fairly well equipped, and we try to operate them to serve the public properly. Believing, as we do, that a good track is the foundation of a good system, we have thoroughly reconstructed the track in both cities with heavy rails. In doing so we have paid the most careful attention to the matter of return circuit, bonding the rails so thoroughly as to make them the path of smallest resistance back to the station. We have thus avoided, to a very large extent, trouble with electrolysis. Nothing is more certain to my mind than that carelessness about making a track return circuit is a most serious mistake, and that carelessness about testing and maintaining joint connections is another. I would rather spend $1,000 or more in providing ample carrying capacity of rail bonds than to put the same amount of money into the overhead circuit, if, by doing the latter, I should neglect the former.

About three years ago the New Haven company found that various electric railways in its territory were gradually extending their operations into the field of interurban work, and that the company's passenger earnings were suffering accordingly. It was at once seen that by no ordinary methods of changing schedules or increasing speeds could this lost traffic be won back again, and, with characteristic knowledge and courage, President Clark and the New Haven directors determined to "steal the thunder" of its new competitors, and commenced a series of elaborate experiments in heavy electric railroading. It must be confessed that this decision was reached only after some misgivings. To the average railroad man street railways have, until recently, seemed a pretty sort of toy, fit for apprentices in the art of transportation. Latterly, however, he has wakened up to the fact that "the tail will wag the dog" unless some radical action is taken, particularly in suburban and short-distance work, and, in the eastern sections of the country, anyway, railroad men have become modest enough to be willing to look with respect upon the great work which has been accomplished in street railroading.

The first line to be equipped by the New Haven company was a purely Summer road, operated for about four months in the year only, through a narrow peninsula running out from the main land on the Massachusetts coast from Nantasket Junction to Pemberton, a distance of about seven miles of double track. This line was chosen partly because the main line operation would not be interfered with in case of trouble with the electric trains and partly because of the existing heavy Summer traffic which would put the new apparatus and the feasibility of the entire system to a severe test. An overhead trolley line was built, with center pole construction, and everything made very strong and more substantial than was at that time found in any street railway work to our knowledge. At the time of construction of this overhead line, there were no suitable movable switches in the market, and we had to remodel and have built especially for our purpose those which we finally adopted. One feature perhaps worthy of note is the connection of the overhead switch with the track switch in such a way that both are controlled by a single lever at the switch stand.

The line was operated for the first Summer with excellent success, and, all fear of trouble having disappeared, an extension of 3.6 miles was made on the main line of the company's Plymouth division, from Nantasket Junction to East Weymouth, this section being operated by the third-rail system.

In December, 1896, we commenced work on a new line running from Berlin, Ct., through New Britain to Hartford, a distance of 12.3 miles, three of which, from Berlin to New Britain, are a double track, and the remainder, from New Britain to Hartford, a single track. A power station was built at Berlin, one end of this line, partly because of a desire to test transmission of power to a considerable distance, and partly because Berlin is the center of several radiating lines, which may eventually be put into operation by electricity.

The physical characteristics of both these lines have been so carefully and accurately described in technical papers that I shall only refer to them more or less incidentally in the following, confining my remarks chiefly to the results which we have found, and the conclusions which we have reached in our own minds as to the best methods of applying electricity in heavy railroad work.

TRAIN SERVICE AND TRAFFIC.

We have learned very thoroughly, in our street railway experience, the lesson of the importance to any transportation agency working in a thickly populated territory of uniform fares and a frequent and regular train service—of a train service which requires no printed schedule to enable people to know when cars may be found in waiting. The time has come when every progressive railroad manager must recognize that new conditions and the new character of competition require a complete change of operating methods.

On its Nantasket Beach line, the New Haven Company gave, during the last Summer, a regular half-hour service from 6.30 in the morning until 11.30 at night. When unusually heavy boat loads arrived at Pemberton from Boston, trains were run in as many sections as were found necessary to take care of the people, but still the half-hour schedule was not departed from on ordinary days. On Sundays and holidays, when boats arrived at Pemberton every fifteen minutes during the greater part of the day, express trains between Pemberton and Nantasket were sandwiched in between accommodation trains in such a way as to give a 15-minute schedule of alternate express and accommodation trains. The time table this Summer required 33 regular trains daily, each way, between East Weymouth and Pemberton. During July and August the traffic increased to such an extent as to require six motor cars in constant week-day service, and on Sundays and holidays, 11 motor cars have frequently been called for.

The fares charged on the Nantasket Beach line before the advent of electricity were 10 cents from Pemberton to Nantasket and 18 cents from Nantasket to East Weymouth, a total of 28 cents from Pemberton to East Weymouth. With electric traction they have been placed at a uniform rate of five cents from Pemberton to Nantasket and five cents from Nantasket to East Weymouth, a total of 10 cents from Pemberton to East Weymouth. Under these new conditions, the traffic has increased enormously on this line; the Summer of 1895, the first of electrical operation, showing an increase of 92.6 per cent over the previous Summer in the number of passengers carried; the Summer of 1896 showing 45.1 per cent increase over 1895, while in the Summer just passed, we have carried nearly three times as many passengers as in the last year of steam operation.

The operation of the line from New Britain to Hartford was commenced in May last, with a regular half-hour train schedule from six in the morning to 11.30 at night, and with a uniform fare of 10 cents each way, instead of 23 cents, the former charge. The electric line carries through passengers only between Hartford and New Britain, the passengers for the five way stations being carried by the regular steam trains running on a parallel track. For ordinary every-day service, a single open motor car was used during the past Summer, while for extra loads, light double-truck trail cars, seating 70 people were attached. On rainy days, a standard closed passenger coach was hauled by the open motor car. On holidays and Sundays the cars pulled two trailers, the entire train seating nearly 250 passengers. About the middle of August, steam service on the Berlin–New Britain branch was discontinued, and traffic has since been handled entirely by electricity. Sixteen trains each way per day are run, connecting with steam trains.

Under the conditions named on the Hartford–New Britian line, we have carried during the three Summer months, 400 per cent more passengers than we carried through the corresponding months of last year.

SPEED, ACCELERATION AND SCHEDULES.

I do not suppose that any but a trained railroad man can understand the impossibility of operating trains and maintaining schedules by steam locomotives in the way that has been done by electricity at Nantasket Beach this Summer. There are a great many curves on the line, and several grades. There are no excessively sharp curvatures or steep grades, and it is not here that the trouble has come. The difficulty is found in the fact that there are no less than 17 stations on a line only 10.6 miles in length, or an average distance between stations of but about .6 of a mile. To make a run of 10 miles, with 16 stops, in 26 minutes; to be *obliged* to do this in order to connect with boats arriving at regular half hour intervals, and to keep out of the way of frequent regular steam trains on the main line of the Plymouth division; to allow but four minutes at each end for unloading, switching (including running around trail car) and loading; and to do this day in and day out, in regular service, through an entire Summer—these are things which can not possibly be accomplished by steam locomotives.

Now, the reason why electricity can do this and steam can not, is found in the tremendous accelerating power of properly designed electric motors, with rotary motion as compared with reciprocal motion of steam locomotives. By examination of the curve of acceleration plotted from actual tests of a 60 ton train, and of the practical results shown in the curve of speed between stations in a service run on the Nantasket Beach line, as well as the time chart made up from the company's printed time cards, it will be seen how enormous is this accelerative power.

It will be seen, for example, that a 60-ton train, in running from Windermere to Allerton, a distance of only 1,800 feet, reaches a maximum speed of 31 miles per hour, while in the longer run from power station to Nantasket Junction, a distance still of but 5,808 feet, a maximum speed of 39 miles is reached. The entire distance is covered, in regular service, at an average speed of 24.6 miles per hour, including stops.

Between Hartford and New Britain the 9.3 miles distance is covered regularly by motor cars with two trailers in from 18 to 20 minutes, an average speed of from 28 to 30 miles per hour, while, with a special high-geared motor, a maximum speed of over 60 miles has been made; the entire distance of 9.3 miles being covered in 10 minutes. On this line a 32-ton train often reaches a maximum speed of 30 miles per hour. The current is cut off at 29 grade crossings when single car trains are run.

It is worthy of note, in this connection, that the line between New Britain and Hartford is in direct competition with a trolley line between the same points, but following a more circuitous route. The schedule time of trolley cars is 55 minutes as against our time of less than 20 minutes, and the rate of fare is 15 cents (including a transfer given for use on the street railways of either city), as against ours of 10 cents for the straight run between the two cities only. The ownership of right of way has a very important influence upon speed and competitive conditions under circumstances like these.

CARS AND EQUIPMENT.

The type of car selected for any good transportation service has a direct bearing upon the development of traffic and maximum gross receipts. It has been difficult for steam railroads to depart far from the long-established custom of closed passenger coaches of the present standard type, and to adopt open cars, on account of the disagreeable effect on passengers of the smoke and gases from engines. This has naturally thrown a great deal of traffic to competing street railway lines running open cars in Summer, on account of the much greater pleasure in riding.

* Read before the American Street Railway Association, Niagara Falls, N. Y., October 21, 1897.

With electric operation, open cars in heavy railroad practice are possible, even at considerable speed, particularly if the front of the car is closed in with glass, and both at Nantasket Beach and on the Hartford–Berlin line, we have used heavy open cars with great success.

The motor car which we have so far used we do not consider, by any means, the final type, and even now we have in mind plans of combination cars, which we believe will be, on the whole, well adapted for railroad work. The present motor car is very heavily built, with floors of a height equal to that of our standard passenger coaches. It contains 16 cross seats capable of seating 96 passengers, and the entrance is from either side, with three steps. Each car has two heavy railroad trucks, one of which is equipped with two 125-horse-power motors. The total weight of the motor car is 32 tons, and the trailer car of the same type weighs 25 tons. The motors which we have used up to date have been of a type common in heavy elevated railway work. These motors have often been in service for several consecutive days, making 324 miles each day, without apparent injury. We found the motors we are using already in the market when we commenced our experiments, and until recently no attempt has been made by us to specify changes. Under these circumstances, great credit is due the manufacturers for their efforts to meet the difficulties encountered. The experience gained with these motors has served as a basis for building larger and heavier types better adapted for the severe work which they will be called upon to fulfill to meet our requirements. An important point which we shall specify in new motors is that they shall have the most perfect ventilation possible. The efforts of manufacturers have been hitherto directed towards completely incasing the motors, so as to make them waterproof, but in doing this, ventilation has been sacrificed.

We have found it beneficial to blow out our motors several times during the day by means of a blast of air from a hose-pipe connected to our air-brake reservoir; but this is at best but a make-shift.

It is very difficult to dispose of all the necessary cables, wires, brake-rods and chains, air-brake cylinders and apparatus, switches and other car-controlling mechanism in the limited space beneath the car floor, as may be readily imagined by those familiar with street railway work. As a consequence, there has always been more or less controversy between those responsible for the placing of the different portions of the equipment as to who shall have the first right to a given space, perhaps hardly a half a dozen square inches in section. There is also more or less trouble with abraded wires, short-circuited shoe-hangers, etc., and, for our future work, we are making an effort to simplify this mass of equipment mechanism by putting some of it, particularly the wires and cables, in a space between the true floor of the car and a false floor several inches below, specially provided for the purpose.

For operating heavy trains of this character, where currents of from 500 to 1,000 amperes are sometimes used, the controlling apparatus must be massive and strong in every part, and the greatest care must be taken to prevent arcing. We have had no trouble with controlling apparatus on our regular equipment, and we consider this branch of the apparatus well perfected.

The danger to station and car apparatus from lightning discharges, which is so important a factor in street railroading where the overhead system is employed, is avoided in third-rail work, since the third rail is so close to the ground that it is practically a lightning arrester itself throughout its whole length.

The problem of braking, which is so important a one in street railroading, is found more so with us since the train weights and speed are enormously greater. The regular Westinghouse air-brake system, with engineer's valve, is used on our electric trains, but instead of steam air compressors we have an electric motor compressor, controlled by an automatic regulator which has given excellent satisfaction.

Our experience with trolleys on the overhead line at Nantasket Beach, originally put in two years ago, has not been satisfactory. We find it quite impossible to prevent the destruction of trolley wheels by almost continual arcing when attempting to take from the wire the heavy current required in starting and during acceleration, as well as the smaller currents taken at the maximum speed. There has been a good deal of trouble, moreover, in keeping the trolleys on the wire in making speed and taking curves, and many trolley poles have been broken. The trolley difficulties have not interfered with the continuous operation of our line, but the cost of replacing wheels and poles has been rather large.

These difficulties have had an important influence in causing us to reach a decision in favor of the third rail. The contact shoes which take the current from the rail to the motor circuit have given, on the whole, good satisfaction, although they are occasionally carried away by the approach blocks at grade crossings when these blocks happen to be slightly misplaced so that the shoes strike them at the wrong angle. The contact shoes are suspended by cast-iron links, which are intended to be weak enough to allow the shoe to break away easily without doing damage to the frame work of the car. The trail cars are also equipped with shoes and connected with the circuits on the motor car by means of flexible couplings, and it is possible, therefore, when the cars are run in train, to bridge the longest gaps found at grade crossings and switches, so that it is not necessary to turn the current off on approaching these. This arrangement makes our trail cars independent of the motor car for heating and lighting.

It will be noted perhaps that the Nantasket cars have two trolley poles as well as contact shoes, and the changing from trolley to third rail simply means the pulling down of the pole and the closing of the third-rail switch.

THIRD RAIL AND RETURN CIRCUIT.

Our third-rail and return-circuit experience will perhaps be of value to both street railway and railroad managers, as we have undoubtedly made a wide departure from established methods. We have solved a number of interesting problems.

First is the question of insulation. The third rail has a potential of 600 volts above the ground and rests upon creosoted wooden blocks doweled into the ties, its eaves being only one and five-eighths inches above the tie. Now it frequently happens that water accumulates two inches or more in depth over the ties, and, if it were not for our experience to the contrary, we would naturally suppose that, under these circumstances, the line would be directly short-circuited between the third and service rails through the water, the distance being but about two feet each way. Nevertheless, we have been able to operate our road without the slightest difficulty when this has happened, and nothing unusual has been noticed at the station, nor has the electrical output, as registered by the recording wattmeter, been abnormal. At Berlin we have watched the ammeter closely when we knew the tracks to be submerged in two places 10 miles apart, during a heavy rain storm, and have found that the leakage was almost imperceptible when both cars on the line were at rest and their air pumps out of circuit. At the same time, the wattmeter was standing still. Of course, if a long length of track were submerged, the leakage might become serious, but we have yet to learn how much is necessary to accomplish this result.

We aim to so connect our third-rail lines and the service rail return as to have a practically complete metallic circuit of extremely low resistance; as far as possible, disconnected with the ground. We do not believe in grounding our track, and, though ground plates are placed at the station, connected to our generator, by far the largest proportion of the return current comes through the cables connected directly with the track, the percentage coming from the ground plates being extremely small.

The joints of the third rail are bonded by long copper plates, firmly bolted to both sides of the joint, 16 bolts being used in all. These copper plates are tinned before being put into position. Owing to the large area of contact surface, the presence of rust on this surface does not materially interfere with the conductivity of the joint, as shown by accurate tests.

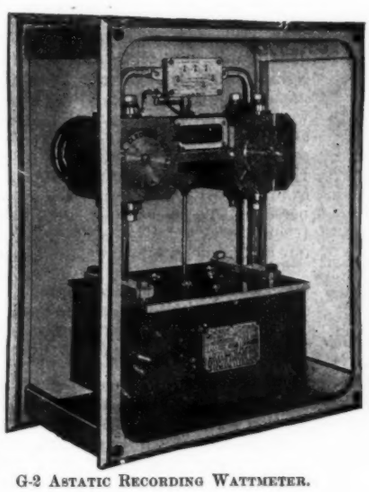
The service rails are bonded with the greatest care, four copper-leaf bonds, having a cross-section of copper equal in conductivity to that of the rail, being used. These bonds are inserted in the base of the rail instead of the web, so as to prevent breakage through play at the joints. The copper leaves are cast into end piece blocks in such a way as to weld them thoroughly together in the blocks. The latter are formed into a hollow cylinder, one inch in diameter, which passes through a hole in the flange, and by which a large area of contact is secured. Tapered pins are driven into the inside of this cylinder from the top of the flange, and the connection made is very perfect. Careful tests have shown that the joints of both third and service rails have now a slightly greater conductivity than an equal length of the rails themselves.

A few words about the danger of the third-rail system would be, perhaps, in order. There have been many cases of people who have stepped from the ground to the third rail without feeling the current, and any one can step upon it from a dry tie without the slightest effect. On all except wet days our employés work about it without trouble, avoiding, of course, putting themselves in direct contact with both service and third rails, but not infrequently "monkeying" with the current in such a way as to get shocks of more or less severity in a sort of horse play. On wet days they refer to the third rail as being "lively," and are inclined to let it alone. Many of our employés have, however, received the heaviest shock possible to obtain, time after time, and care little about it, though those who are more influenced by electric shocks than others are sometimes thrown off their feet, but recover fully in a few minutes. We do not say that the third rail has no dangers, but we do not consider the danger as being at all serious, or one which should interfere with the extension of the system.

[To be concluded.]

G-2 Astatic Recording Wattmeter.

The construction by the General Electric Company of a recording wattmeter of sufficient capacity to measure and regulate the total output from the generators in central railway or lighting stations, met a demand, created by the new conditions of electric practice. The character of this demand may be gauged by the fact that a recording wattmeter which three years ago would have been regarded as of enormous capacity is to-day considered small; meters of 10,000 amperes are now commonly called for, while inquiries have been made for sizes registering as high as 16,000 amperes. Measurement of these heavy capacities precluded the use of any form of wound meter field, and the Thomson recording wattmeter had necessarily to be modified. Furthermore, the rapidly growing



G-2 Astatic Recording Wattmeter.

tendency to set the bus bars closer together, and bring the switchboard into the least possible space, has rendered it advisable that large meters of this character, where intended for boards of modern construction, should be astatic. While on the majority of swichboards an astatic wattmeter is not necessary, there exist cases in which the best metering results could not be obtained without one; and that total station output meters might be applicable alike to all switchboards, whether within heavy projected fields or not, the G-2 meter has been designed and is manufactured in an absolutely astatic form.

In the G-2 meter, the field is a single straight bar of forged copper, above and below which are placed two armatures, arranged astatically and having a common commutator. The damping device is also double and astatic, the polarities of the upper and lower group of damping magnets being opposite. The damping mechanism being inclosed within an iron shielding box, any stray leakage lines of an unbalancing character are prevented from entering. The G-2 meter is so independent of local or stray influences that it may be installed directly in front of the very heaviest busses without the introduction of any inaccuracy.

The entire meter is held in position upon the switchboard by two studs which form at once the electrical connections and the mechanical support of the instrument. These pass through the board and are bolted to the bus bar by binding nuts with large contact surfaces. The cover is of beveled glass set in a polished brass frame fastened to the board.

STREET RAILWAY MEN.

(*Concluded from page 199.*)

Mr. W. J. Hield's paper on "Damages" was read and the author thanked.

The nominating committee then made its report as follows:

For president, Albion E. Lang, of Toledo, Ohio.
First vice-president, W. Caryl Ely, of Niagara Falls, N. Y.; second vice-president, John A. Rigg, of Reading, Pa.; third vice-president, Edward G. Connette, of Nashville, Tenn.
Secretary and treasurer, T. C. Penington, of Chicago, Ill.
For executive committee, Robert McCulloch, of St. Louis, Mo.; C. Densmore Wyman, of New Orleans, La.; Henry C. Moore, Trenton, N. J.; John M. Roach, of Chicago, Ill., and Robert S. Goff, of Fall River, Mass.
For place of meeting the committee recommend Boston, Mass.

The report was accepted, and the gentlemen named elected.

FRIDAY'S SESSION.

President McCulloch called the meeting to order at 10.45 A. M.

Mr. Kerper, of Dayton: I move that a vote of thanks be tendered to the president, vice-president and the executive committee for the able manner in which they have conducted the affairs of the association during the past year. **Carried.**

Mr. Rigg, of Reading: Mr. President, I desire to offer the following resolution: "*Resolved*, That the members of the American Street Railway Association, in annual meeting assembled, express their thanks to the several passenger associations of the United States for their courtesy in granting reduced rates to the members of this association and their friends who are in attendance upon our annual meeting." Carried.

The chair appointed a committee on transportation, consisting of Messrs. Penington, McGraw and Windsor. Votes of thanks were extended to the local street railway companies, the manufacturing companies and the International Hotel for courtesies; also to the ladies' reception committee.

President McCulloch introduced the new president, saying: Mr. Lang, I am glad to turn over to you, sir, the gavel of the association. I hope that you will hold the office of president of the American Street Railway Association with as much pleasure and satisfaction and as much pride as I have, and I wish you the same courteous treatment and the same support in your administration that I have received. (Applause.)

President Lang: Gentlemen, I wish to assure you of my profound pleasure in being called to this office. I deem it a great honor, from the fact that I was in no sense a candidate for the office. My place in the association has simply been that of a quiet and earnest listener, endeavoring to learn all I can for the property I represent. We have had opened up to us in the papers presented at this meeting a number of interesting questions that will command our earnest attention, and some of the improvements suggested we will want to introduce in our system in the course of the coming year. Other questions will arise, which will require our attention at our next meeting. I do not think it is proper at this time to enter upon the discussion of any questions of a practical nature. If I am as successful as my predecessor, and as successful as his predecessors have been, in keeping up the interest in this organization, I shall be very thankful. It does not lie entirely with the officers of the association to make a success of the association, it depends upon its members; and, as we send out communications during the year asking for suggestions for topics to be considered at the next meeting and the assignment of persons to prepare the papers, I hope you will give the matter your prompt attention. (Applause.)

The meeting then adjourned, to convene in Boston, Mass., in 1898, on such date as may hereafter be designated by the executive committee.

CONVENTION NOTES.

The Jewell Belting Company, represented by Mr. C. L. Tolles, gave out a very popular souvenir. It was a cigar case made of fine leather, with such a modest little mention of the donor in it that every one was delighted to receive it.

"Brightest spot in the hall" was the remark appropriately applied to the space so attractively occupied by the Central Electric Company, of Chicago. A number of note-book souvenirs were given to visitors. Mr. W. P. Garton, of Chicago, assisted Mr. H. E. Adams in looking after the interests of the company and in welcoming the street railway men.

Mr. D. B. Dean, of the Terre Haute Car Wheel Company, was busy meeting his many friends.

At the Cataract House, the General Incandescent Arc Lamp Company, of New York, exhibited arc lamps and quick-break switches for 500 volts. Their handsome quarters were visited by scores. Mr. E. Lavens, the general manager of the company, was present.

Mr. Chas. A. Bragg, of Philadelphia; Mr. E. H. Heinrichs, of Pittsburgh, and Mr. R. S. Brown, of Boston, were among the genial representatives of the Westinghouse interests.

Mr. Charles Yerkes Flanders, representing Morris, Tasker & Company, of Philadelphia, and the National water tube boiler, of New Brunswick, N. J., renewed acquaintance with a thousand or more friends, and gave out a souvenir for the latter company in the shape of a transparent purse, with leave to fill.

Mr. H. L. Shippey, secretary of the John A. Roebling's Sons Company, with Messrs. Cockey and Bailey, of Chicago, ably and conspicuously represented this great company. The friends these gentlemen have in street railway circles is legion, and their number is growing.

Dr. W. M. Habirshaw, the head and front of the India Rubber and Gutta Percha Insulating Company, of New York and Yonkers, made his headquarters at the Cataract House except while in Buffalo. Mr. F. W. Harrington, of the same company, was also present.

Major H. C. Evans and Mr. James A. Rutherford were to be found at the headquarters of the Johnson company's interests. The Major is probably the best known attendant at the street railway gatherings of the United States, and Mr. Rutherford also numbers his friends by the score, and has cause to be highly elated over the reception accorded the new motors for street cars that his company is now introducing. Their headquarters were a busy and constantly changing scene.

The ELECTRICAL REVIEW was represented by Chas. W. Price and S. H. Goddard, of New York, and C. E. Kammeyer, of Chicago. The arrival of this journal from New York Wednesday morning with a report of the first day's proceedings, list of those present, and a description of the exhibits and picture of the exhibition hall, as it looked Monday morning, was a newspaper feat that received many compliments from the street railway men, all of whom seemed to appreciate the enterprise of Mr. S. H. Goddard, who so successfully carried it through.

A cane souvenir was bravely started by one company, but the supply soon became exhausted.

Major L. N. Downs, the street railway magnate of interior Michigan, renewed acquaintance with a large crowd of old-time electrical friends, who had known him when he was prominent in telephone circles a dozen years ago.

Capt. Willard L. Candee, the energetic and up-to-date head of the Okonite Company, Limited, New York, was present in person for two busy days during the convention, and brought with him some samples of the new Candee improved feeder wire, which provoked a great deal of interest among the users of this product in street railway circles. It is adapted for both aerial and underground use, and from the compliments the street railway men who saw it expressed, it is evident that it will make a hit in this field. It is one of the latest products of the factory of the Okonite Company.

Messrs. P. C. Ackerman, of New York, and F. E. Donahue, of Chicago, ably and enthusiastically represented the American Electrical Works, of Providence.

Mr. J. S. Crider, secretary of the Washington Carbon Company, spent several days at the convention, largely increasing his friends among the street railway men.

The Pettingell-Andrews Company, of Boston, was ably represented by Mr. Wilson.

Mr. T. B. Purves, Jr., superintendent of the rolling stock of the Boston & Albany Railroad, attended his first street railway convention, and was greatly interested in what he heard and saw. Mr. Purves makes his headquarters at Springfield, and keeps thoroughly abreast of what is going on in the electrical field, and will be one of the enterprising steam railway men ready to know what to do when electricity becomes a prominent factor on his road.

Mr. W. Worth Bean came in from Michigan looking younger than ever.

Among all the displays at the convention, there was none that was visited oftener or more inquired about than that of the Electric Storage Battery Company. The storage batteries were placed with measuring instruments, etc., in a plan suitable for use in a power station. General Manager Lloyd, of Philadelphia, and Mr. Charles Blizard, manager of the New York office, were in constant attendance and street railway men found in them a constant source of information by which they all profited. They had fine headquarters in addition in the best parlor at the International Hotel.

The most delightful affair growing out of the convention was a dinner given by Mr. J. G. White, at the Buffalo Club, Tuesday evening, to a number of his electrical and street railway friends. There were about fifty in attendance, nearly all of them coming down from Niagara Falls on the electric road and returning after the dinner. A few stayed over in Buffalo. The theater of the Buffalo Club was handsomely decorated with flowers and flags, and a superb dinner, with rare wines, was well served. An excellent orchestra was concealed amid the flowers. While there were no set speeches, a number of gentlemen could not resist the opportunity to express their admiration of the high-grade work done by Mr. J. G. White and his talented associates, in the construction of street railways in various parts of the country, and in the building of the Niagara Falls and Buffalo electric transmission line, for which he was given *carte blanche* by the capitalists interested. Mr. White, after modestly bearing this for some time, proposed the health of Mr. W. Caryl Ely, and suggested his name as the next president of the American Street Railway Association, which was received with applause. Among those present were Mr. J. G. White, Mr. George H. Walbridge and Mr. H. H. Harrison, of J. G. White & Company, and Messrs. Charles R. Huntley, George Urban, Jr., W. A. Brackenridge, B. F. Thurston, Joseph De Vine, Charles W. Price, Paul M. Lincoln, W. J. Clark, W. Caryl Ely, Burt Van Horn, Charles B. Defreest, T. C. Martin, L. B. Stillwell, H. H. Littell, Charles S. Sergent, C. F. Holmes, T. C. Penington, Capt. Robert McCulloch, Capt. J. M. Brinker, Col. Ashley W. Cole, Dr. W. M. Habirshaw, Col. H. M. Watson and Col. D. B. Dyer.

A complimentary dinner was given the executive committee by Messrs. Watson and Littell, of Buffalo.

The treasurer's report shows net assets of $4,571.48. There were 15 new members added during the year, and some 12 or more came in at Niagara Falls. The executive committee voted to thank the ELECTRICAL REVIEW and other technical papers for courtesy in publishing notices sent out by Secretary Penington.

The official headquarters of the General Electric Company occupied the writing-room of the International Hotel. Here it had erected a small booth in which an X-ray exhibition was given continuously. The walls of the writing room were hung with neatly framed diplomas, and with these a large volume on the table made an excellent showing of the General Electric Company's prominence at great expositions. For the first time a large number of the medals awarded to it were also shown. The social side was not neglected by the General Electric Company. On Tuesday it arranged an enjoyable tally-ho and carriage party over to Canada. This courtesy was taken advantage of by nearly every lady at the convention. Parlor 2 D was the company's social annex, which, after about 9 P. M., seemed a remarkable center of attraction for every one.

Probably the most popular headquarters at the International Hotel were the parlors occupied by the J. G. Brill Company, where Messrs. John A. Brill, W. H. Huelings and G. M. Haskell welcomed the visitors. The question was, "When do these genial gentlemen ever sleep?"

The Western Electric Company, of New York, Chicago and all Europe, was actively represented by Mr. Samuel A. Chase, of the metropolis.

Capt. Frank H. Clark, U. S. A., retired, was one of the several bright men representing the Electric Storage Battery Company.

The Sterling Supply and Manufacturing Company, New York, was ably represented by Mr. F. A. Morrell. This company is one of the standard ones in the electric railway field. The absence of President J. H. Carson was regretted by a large circle.

Col. J. N. Partridge, of Brooklyn, one of the ablest and most widely known of street railway presidents, stopped off at the convention, on his return from a trip to California.

Mr. M. L. Livingston, of the Standard Thermometer and Electric Company, of Peabody, Mass., was among the prominent visitors at the convention.

The H. W. Johns Manufacturing Company, of New York, was represented by Mr. J. E. Meek, of New York, and Mr. H. H. Luscomb, of Hartford. The company occupied a space in the main hall, where the

electric heaters made by them were shown; also samples of the overhead trolley equipments composed of molded mica.

Mr. H. T. Richards, of the Safety Insulating Wire and Cable Company, of New York, spent Sunday and Monday with the convention. The wire made by this company is used on many of the largest electric railway systems in America, and the "Safety" product is recommended by the railway interests as a most serviceable one, among which are the Peoples' Traction Company, of Philadelphia; West Chicago Street Railway Company, Union Traction Company, Philadelphia; Chicago City Railroad Company, North Chicago Street Railroad Company, and the West End Street Railroad Company, of Boston.

The interests of the railway department of the Westinghouse Electric and Manufacturing Company were represented by Messrs. E. W. T. Gray, Pittsburgh; W. F. Zimmermann, New York; C. A. Bragg, Philadelphia; J. R. Gordon, Atlanta, Ga.; R. S. Brown, Boston; Maurice Coster, Chicago; Paul T. Brady, Syracuse; R. T. Frenyear, Buffalo; B. F. Storer, R. T. Mallet, Robert Siegfried, G. B. Lyfard, E. H. Heinrichs, Pittsburgh, and Messrs. W. K. Dunlap and M. McLarer were in charge of the exhibit. The interesting feature of the exhibit was the "Booster Outfit." This is a portable motor, running a series-wound 300-kilowatt generator, also with a complete switchboard and necessary appliances for operation.

Mr. C. E. Greene, of the Cataract House, took charge of an exhibit at the convention hall for Fred M. Locke, of Victor, N. Y., the manufacturer of insulators. Mr. Locke has recently taken out patents on high-potential insulators known as the "Niagara" type; these were exhibited with the other forms of insulators of the various types.

The Creaghead Engineering Company, of Cincinnati, showed flexible bracket construction for electric road service; also a line of overhead materials and malleable iron pole-fitting strain insulators and section insulators. The display was in charge of Superintendent G. R. Sarghen; he distributed a little souvenir in the shape of a steel pocket rule in a leather case.

The Elmer P. Morris excursion and brass band were important episodes of the railway meeting. Mr. "Johnsing" also was a worthy functionary, and presided with grace and dignity over the parlors occupied by Mr. Morris. This gentleman, Mr. "Johnsing," as he is familiarly known, was a colored man, six feet three inches in height, and wore a suit of white duck well emblazoned with mottoes, and when not dispensing hospitality or leading the "Morris band" in evening parade, he assisted in entertaining the guests.

The General Electric Company had an exhibition of the new railway arc lamps.

The J. G. Brill company, of Philadelphia, aside from the elaborate preparations made at the exhibition hall for exhibiting the various types of the Brill trucks and cars, established headquarters at the International Hotel, where receptions were held each evening. The men connected with the Brill interests are most popular gentlemen at the street railway meeting, and the Brill coteries are always distinguishable.

President Stevens, of the Keystone Electrical Instrument Company, stayed at the Cataract House during the entire session. This company had a complete switchboard in store, and gave practical illustrations of the efficiency of the various forms of instrument which they made. Mr. Stevens assisted Mr. E. P. Morris, the New York representative of the Keystone company, in receiving and entertaining.

H. W. Ransom, one of the popular young men identified with the street railway interests, and a social leader at the evening receptions, was in charge of a very artistically prepared booth showing the standard forms of the consolidated car heaters made by the Consolidated Car Heating Company, of Albany, N. Y., of which he is sales agent, with offices in New York.

Mr. Robert Kirkland, representing the interests of the Cutter Electrical and Manufacturing Company, exhibited the largest and also the smallest circuit breaker ever made. The Cutter apparatus is recognized as standard in street railway powerhouses, and the newer principles involved in the circuit breakers now being made by the company was of

VIEW OF EXHIBITS OF J. G. BRILL AND STANDARD AIR-BRAKE COMPANIES, NIAGARA FALLS CONVENTION.

interest. Mr. Kirkland's assiduity and activity in convention work for the Cutter company was constant.

Mr. Geo. C. Ewing, of Huntress & Ewing, Boston, dealers in street railway materials, was with the convention; also Mr. Arthur S. Partridge, of St. Louis.

Mr. J. E. Storey, president of the Storey Motor and Tool Company, of Philadelphia, came with the Philadelphia delegates and remained through the convention.

Harold P. Brown, who controls the Plastic rail bond, distributed literature on rail bonds.

Mr. Frank Laughlin, of the Solar Carbon Company, Pittsburgh, and Mr. H. E. Webb were present.

H. C. Spaulding, of Boston, representing the Manhattan General Construction Company and the Siemens & Halske Electric Company, was present.

A pretty souvenir letter opener was distributed by Hayes & Arthur, Cleveland.

Mr. S. B. Condit, Jr., general manager L. A. Chase & Company, of Boston, makers of the Elden alternating machine circuit breaker, reached Niagara Falls Wednesday night and remained the following days.

Mr. Robert H. Derrah, president's clerk of the West End Railroad, Boston, engineered Boston's work for gaining the '98 convention, and Mr. Derrah's energy and judgment were rewarded. There was a marked disposition pervading the convention to go East for the next convention rather than to Cincinnati or Omaha, both of which cities asked for the meeting. When the decision to hold the next year's convention in Boston was made the applause was tumultuous.

Managers Greenwood and King, of the International Hotel, deserve commendation for the manner in which they handled the crowds during the days of the session. The International Hotel, as well as the Cataract House, were both more than full, and the facilities of the houses greatly taxed.

The Diamond Truck Company showed one of the largest extra long diamond trucks. Mr. Tenbroeck of this company was in charge.

The Clonbrock Steam Boiler Company had a set of models illustrative of the "Morrin Climax" boiler, also a large number of photographs showing the many steam railway power plants which they have installed. Mr. Thomas F. Morrin, president, and Mr. C. H. Sammons were present.

The Garl Telephone Company had the only telephone exhibit at the convention. This company is placing on the market a number of new forms of instruments, and took advantage of the opportunity to bring before the electrical field their new apparatus.

Secretary Garrison, of the Columbia Incandescent Lamp Company, of St. Louis, Mo., was a very active conventionist. This company does a large business, which includes many street railroad companies throughout the country.

The various forms of the "Camp" conduit, manufactured by H. B. Camp & Company, of Aultman, Ohio, were exhibited.

The American Street Railway Association adopted resolutions indorsing the organization of the Street Railway Accountants' Association.

The paper by Mr. G. W. Knox, of Chicago, on "Difficulties of Constructing and Operating Electric Railways," was very highly complimented. It will be published later in the ELECTRICAL REVIEW.

The all wrought-steel pulley, exhibited by the American Pulley Company, Philadelphia, attracted a good deal of attention from the owners of power stations.

General Electric Co.: C. D. Haskins. Convention committee: E. M. Kimball, secretary, Boston; T. Beran, New York; A. D. Page, manager incandescent lamp department, Harrison, N. J., and John McGhie. The sales offices were represented as follows: New York, W. G. Bushnell, A. B. Shepard; Chicago, T. P. Bailey; Philadelphia, F. G. Mullen, N. J. Crowley; Boston, C. C. Pierce; Cincinnati, W. F. Hays, F. H. Strieby and B. E. Corson; Atlanta, S. W. Trawick; San Francisco, F. F. Barbour.

The convention hall, though not as large as the one in St. Louis last year, was an attractive and animated scene, and the exhibitors vied with each other in artistic decorations and attractive arrangements and displays. Naturally, an exhibition of street railway equipments and apparatus would not be as pleasing to the eye as an orchid show, but there is very much—from a beautifully constructed huge power generator and a complete street car with its motor, air-brakes and all appurtenances in position—to interest even the lay man and naturally of much interest to those who are directly interested as an opportunity to become fully posted on the most modern construction and appliances.

The Jandus Electric Company, of Cleveland, exhibited a number of the standard inclosed arc lamps made by this company and so widely used.

The New Haven Car Register Company established headquarters near the main entrance of the convention hall, and displayed a complete line of the various forms of the New Haven cash register. Messrs. Bradley and Boyd, of the company, were both in attendance, and their booth was a mecca for many visitors. The souvenir given away by the New Haven company was a pretty paper cutter.

E. P. Sharp, who has built up quite a large business in Buffalo as agent for second-hand street railway apparatus, was almost daily at the convention.

Owing to the rainy weather Wednesday night the lighting of the Whirlpool Rapids was postponed, and took place on Thursday evening, though the rain came again that night and rather lessened the attendance.

F. W. Darlington, the electrical engineer of Philadelphia, who built the Brooklyn electric fountain, spent two days at the meeting.

The Gales commutator compound was very attractively brought to the attention of all in attendance by means of some handsome advertising signs hung throughout the hall. It is regretted that Manager Isaacs was prevented from attending, on account of being detained by business in Chicago.

The "McRoy" conduit was shown at the exhibition. Mr. John T. McRoy was present in person.

The Hemingray Glass Company, of Covington, Ky., which produces a standard line of glass insulators widely used in the electrical field, was represented by president D. C. Hemingray, who was cordially welcomed as one of the popular gentlemen from his state.

Mr. Franklin Sheble, of Sheble & Patterson, Philadelphia, dealers in second-hand electrical apparatus, spent two days at the convention.

Mr. MacGovern, a member of the well known firm of Rossiter, MacGovern & Company, of New York, was an element in the social side of the convention meetings.

About 300 ladies were with the convention, and the plans of the entertainment committee had been well arranged for their pleasure, although the threatened weather Thursday and Friday somewhat marred the order of the days. Drives, trolley rides, trips along the Whirlpool Rapids, to return on the Canadian shore after crossing by ferry, and dances in the evenings, were enjoyed.

The banquet Thursday night was attended by more than 300 people. The tables were filled at eight o'clock, and a little after ten o'clock the toastmaster introduced the first speaker of the evening. The gather-

(Concluded on page 210.)

APPLICATION OF THE STORAGE BATTERY TO ELECTRIC TRACTION.*

BY CHARLES HEWITT.

To give a history of the application of the storage battery to electric traction would only be turning over dry bones. The long series of remarkable failures is no doubt familiar to all. To say that the storage battery has no place in electric traction is an error, and, on the other hand, to say that it will supplant all other means of applying power to the cars is, I believe, only the dream of the enthusiast. We are sufficiently acquainted with the possibilities and limitations of the storage battery of to-day to be able to make installations whose success will be certain; improvements in manufacture have certainly been made during the past few years, but the cause of past failures has been due quite as much to errors in installation and in manipulation as of manufacture. * * * *

A phase of the battery car system is the battery locomotive. Aside from special forms, such as the Heilmann locomotive, the one most worthy of mention is the experiment on the New York elevated railway, in which the battery is connected in multiple with the motors and charges or discharges according to the demands of the train. When the demand of the motors is sufficient to lower the pressure on the line to or below that of the battery, the battery will then discharge into the motors, thus relieving the feeders. When current is shut off from the motors the battery will charge. No results of this experiment have been made public yet, but it is difficult to see how much is to be expected. It has the advantage of maintaining a fairly constant pressure at the motors, but this can be accomplished better in other ways, as I shall show later. It subjects the battery to usage which history has proved to be disastrous to its life and efficiency. In this method the extra weight of the battery has the certain advantage of giving additional adhesion to the rails. While not wishing to seem pessimistic, I must confess that to me the outlook for the battery car is not bright, and I do not look for much improvement, unless some combination of elements be discovered whose characteristics are entirely different from the lead battery. * * * *

From our experience in operating power-houses of various capacities we find that a power-house operated at Chestnut Hill under conditions which I have described would cost about one and a half cent per kilowatt hour. We, therefore, get the following as the cost of generating the number of kilowatt hours required by the Chestnut Hill branch during the month of October, 1896, if furnished by a station at Chestnut Hill:

134,848 kilowatt hours at 1½ cents	$2,022 73
Interest on $85,000 at 5 per cent per annum	354 17
Depreciation at five per cent per annum	354 17
Insurance, taxes, etc	200 00
Total cost of operation for the month by direct method	$2,931 07

Actual cost of operating the battery and booster:

Watt hours delivered to cable No. 3 by bus-bar	136,576,919
Watt hours generated by booster	34,234,648
Total watt hours delivered to cable No. 3	170,811,567

The cost of operating the power-house for the month of October, exclusive of interest and depreciation, was seven mills per kilowatt hour; therefore, we obtain the following:

170,811,567 kilowatt hours at .7 per cent	$1,195 68
Cost of labor and supplies at battery house	179 73
Total	$1,375 41
Depreciation of battery at five per cent per annum	88 33
Interest at five per cent per annum on $33,000	137 50
Taxes, insurance, etc	32 00
Total cost of operation	$1,628 24

Deducting this from the cost of operating by a station at Chestnut Hill, we find the difference in favor of the battery for the month would be $1,302.83. Since October 1, 1896, the method of operating has been somewhat changed, and by installing wattmeters more accurate data have been obtained.

During the month of May, 1897, the following results were obtained:

Delivered to cable No. 3 at 550 volts	101,750,000 watt hours
Delivered to cable by booster 28,360,380	"
Total delivered at station	130,710,380 "
Total delivered at battery house	103,673,448 "
Less amount lost in battery	620,000 "
Total output at battery house to line	103,053,448 "
103,053,448 watt hours at 1½ cents per kilowatt hour	$1,545 80
Interest on $85,000 at five per cent per annum	354 17
Depreciation at five per cent per annum	354 17
Insurance, taxes and miscellaneous	200 00
Total cost for May, 1897, by direct method	$2,454 14

Actual cost of operating battery:

130,710,380 watt hours at .6 cent per kilowatt	$784 26
Cost of labor and supplies	163 67
Total	$947 93
Depreciation of battery at five per cent per annum	88 33
Interest at five per cent per annum on $33,000	137 50
Taxes, insurance and miscellaneous	32 00
Total cost of operation	$1,100 76

NOTE—Cost of operating power-house for May, 1897, was .6 per mill per kilowatt hour. Five per cent depreciation of battery is amount guaranteed by makers. Deducting $1,100.76, the actual cost of operating battery for May, 1897, from $2,454.14, the cost if station had been built at Chestnut Hill, we find a saving of $1,353.38 in favor of the battery.

We may safely say, therefore, that the saving by using the battery is about $1,350 per month or about $16,200 per year.

RECAPITULATION.

Saving in cost of installing battery over a new power station for Chestnut Hill	$52,000
Saving in operation per annum	16,200

These results speak for themselves, and need no further comment. The following data may also be of interest:

	October, 1896.	May, 1897.
Highest charge for 24 hours	456,000 watt hours.	300,000 watt hours.
Lowest charge for 24 hours	312,000 "	150,000 "
Average charge for 24 hours	385,161 "	218,380 "
Highest discharge for 24 hours	456,000 "	250,000 "
Lowest discharge for 24 hours	316,000 "	150,000 "
Average discharge for 24 hours	329,419 "	198,380 "
Average efficiency for the month	85.5 per cent.	90.8 per cent.
Average day charge in amperes	46	45.8
Average night charge in amperes	155	
Average discharge in amperes	50	43.7
Ratio of the night charge to the day charge	Highest 4 to 1. Lowest 1½ to 1. Average 2.63 to 1.	
Ratio of day charge to discharge	Highest 1 to 4.45 Lowest 1 to 1.86 Average 1 to 2.95	1 to 1.5 1 to .78 1 to 1.10

SPECIFIC GRAVITY.

Maximum specific gravity at 6 A. M.	1.200
Minimum " " " 6 "	1.2
Average " " " 6 "	1.207

The above are the specific gravities at the end of full charge.

Maximum specific gravity at 6 P. M.	1.201
Minimum " " " 6 "	1.184
Average " " " 6 "	1.192
Maximum specific gravity at 12 P. M.	1.194
Minimum " " " 12 "	1.182
Average " " " 12 "	1.188

At a specific gravity of 1.16, the battery would be about empty; so that we find at no time was the battery more than half discharged. At the end of 15 months of continuous operations we have only had to repair two leaky tanks, at an expense of about $25. The positive plates look as good as when first installed, and show no depreciation whatever; the negatives, on the other hand, have contracted somewhat, and some of the plugs have cracked, but this in no way impairs their usefulness.

This method of power distribution can not be considered economical *per se*, but, where the conditions are such as we have described, there is no question as to the economy in favor of the battery.

The application of battery to power-house has not become very generally appreciated in this country, and but few installations have been made. As its advantages become better known I feel confident the practice will become more general. The wide fluctuations in load in railway power-houses are now well known. The average daily load varies from 50 per cent of the maximum in small stations to 70 per cent of the maximum in the largest stations. From a very large number of observations in all parts of the country I find that in the majority of stations the average load is very close to two thirds of the maximum load. Now, it is also a well known fact that the maximum economy of the steam engine exists for a very small range of load, and that on each side of the point of maximum economy the efficiency falls off; rapidly on the overload, somewhat less rapidly on the underload. The result is apparent. In most stations the engines, at the best, have an average load of only two-thirds of their most efficient load, and as a consequence, consume over 4.5 pounds of coal per kilowatt hour. With badly regulated engines, and especially with water-power plants, the changes in load are accompanied by variations in speed and consequently in voltage. These troubles may be entirely corrected by installing a battery.

The battery in this case becomes distinctly a load regulator. No cost figures of these plants are made public, but the increased efficiency is made apparent. It is necessary that the capacity of the battery should bear a larger ratio to the output of the station than is necessary for potential regulation. In potential regulation a comparatively small battery is necessary, since by changing the potential of booster from time to time during the day, the charge and discharge can be kept very low. In the case described, a battery rated at 120 amperes has successfully regulated for a total output of 1,400 amperes. For load regulations, however, the battery should have a capacity equal to one-third the maximum output of the station. The average load of the station may then be made the maximum load of the engines, the battery taking care of the fluctuations. There are no physical limitations to be placed on the size of the plates to be used, and the charge and discharge may be kept well within the normal rates. Under such conditions the efficiency of the battery is high—85 to 90 per cent—and the deterioration very low. In most cases no additional labor will be required.

The ELECTRICAL REVIEW has received, with the compliments of the author, a pamphlet, entitled "Physical Measurements," containing a paper read before the Contemporary Club, of Davenport, Iowa, in February, 1897, by Col. William R. King, U. S. A.

*Read before the American Street Railway Convention, October 20.—Abstract.

ADVANCE INFORMATION

Electric Light and Power.

GRAND FORKS, B. C.—The City Council has accepted the bid of Contractor Davies to put in a light and water plant for the city at $15,974. The light system will consist of 1,000 incandescent and five arc lights.

WOBURN, MASS. — The Woburn Electric Light and Power Company are making arrangements to furnish their plant with an entire new outfit with all modern improvements.

APPLETON, WIS. — Langstadt & Croswell have secured the contract for the wiring and equipping for electric lights for the new Wickwire & Steele flat building in Oshkosh. The building will have 17 flats and 300 electric lights.

GREENTOWN, IND.—The electric light company is preparing to put in a splendid system of arc lamps for the lighting of stores.

PHILADELPHIA, PA.—A movement is on foot to erect a plant for the purpose of furnishing electric light to Sellersville and Perkasie. It is proposed to build a power station midway between the two places.

SAN FRANCISCO, CAL.—The Alameda County Light, Fuel and Power Company has been incorporated, with a capital stock of $1,000,000, by William A. Clark, Philo Wells, Edwin S. Irwin, William H. Payson and Fred H. Busby.

CASSELTON, N. D.—The Triumph Electrical Company, Cincinnati, Ohio, represented by Frank B. Thompson, has been awarded the contract for the electric light plant for this place.

CHARLESTON, S. C.—The Charleston Cotton Mills has contracted for the establishment of an electric light plant in its factory.

NEW LONDON, CT.—The Columbia Steam Saw Mills will probably be equipped with electricity.

MARSHFIELD, WIS.—The city considers purchasing water and electric light plant which is operated in this city. The price asked is $10,000, to be paid in installments.

CUMBERLAND, MD.—The Mayor may be addressed concerning proposed electric light plant, to cost $19,000.

SEDALIA, MO.—The Missouri Heat and Light Company has asked for a franchise to light the city. If a franchise is granted, a new plant may be erected.

LOS ANGELES, CAL.—The San Gabriel Electric Company will be in position to supply arc and incandescent lights and power for all purposes on February 1, 1898.

ASHEVILLE, N. C.—The Asheville Electric Company has been incorporated, with Dr. John H. McAden, president, and James H. Cutler, secretary and treasurer. Capital stock, $200,000. The new company will take the property of the West Asheville Improvement Company, make substantial improvements, and continue the electric lighting business.

Kindred.... ...Interests

The Electric Arc Light Company, of New York city, have removed their offices from 687 Broadway to the American Tract Society Building, 150 Nassau street. Mr. W. C. Hubbard has been elected secretary of the company.

The Pacific Electric Company, La Crosse, Wis., has just closed a deal whereby 500 of their well known Espersen adjustable shades will be shipped to Paris, France. This is said to be the largest sale of shade lamps ever made to a European firm.

Alexander Smith & Sons' Carpet Company, of Yonkers, N. Y., have placed the contract for two new fireproof dye houses with the Berlin Iron Bridge Company, of East Berlin, Ct. These buildings are 50 feet wide and 100 feet long, built entirely of steel, no woodwork being used at all in the construction.

The Stirling Metal Company, of Stirling, N. J., whose New York offices are at 102 and 104 Fulton street, New York city, in charge of Mr. William E. Locke, sales manager, has sent out to the trade a very interesting booklet describing the Stirling anti-friction metal and the various grades of Babbitt metal, white brass, car and journal boxes manufactured by this company.

The Phœnix Carbon Manufacturing Company, St. Louis, Mo., has prepared a handsomely illustrated catalogue, showing its complete line of carbon products for all purposes. The company calls special attention to its improved carbon galvanic batteries, which it recommend as the highest type of battery on the market. This company also manufactures the well known Phœnix dynamo and motor brush, as well as carbon parts for telephones, etc.

J. H. Bunnell & Company, 76 Cortlandt street, New York city, have just issued their new catalogue, No. 16. They claim it to be the most complete catalogue of general electric supplies published. It contains illustrations and descriptions of a number of new and useful devices which should be of interest to the trade at large. This company also issue in addition special catalogues of miniature and decorative incandescent lamps, open and long burning arc lamps for both direct and alternating circuits, phonograph mus cal records and supplies, and an abridged catalogue and student's manual of telegraphy. Any of these will be sent free on application.

The Central Telephone and Electric Company, 1123 Pine street, St. Louis, Mo., is the name of a new telephone manufacturing company, which was formerly conducted by Messrs. D. A. Kusel and James S. Cuming, under the firm name of the D. A. Kusel Telephone Manufacturing Company. Mr. Kusel has sold his interest and good will in the business to Mr. R. T. Durrett, who will have charge of the financial end of the new business, while Mr. Cuming will devote his services to the practical management of the company. The Central Telephone and Electric Company expects to issue a new catalogue and price list. A revised price list is now ready to be distributed and may be had on application.

Ivory Name Plates—The Endolithic Ivory Company, of London, has appointed the Western Electric Company, of Chicago and New York, as agents for its goods in the United States. The company manufactures all kinds of name plates for dynamos, testing instruments, switchboards, furniture—in fact, for anything where a name plate may be used. The Western Electric Company is using these name plates on the desk fans manufactured by them. These plates are either of bone or ivory, with the name engraved upon the material and colored by a special process. Any one looking for a durable and handsome name plate for any material which they manufacture would do well to send to the Western Electric Company—either in Chicago or New York—for a sample. Telegraph companies have been using these name p'ates to a great extent.

The Ayers' self-locking arc lamp windlass is not a new article and is reasonably well known to the trade. It has not, however, received the attention as a specialty which an article of this kind needs to get it properly before the buying public. The Electric Appliance Company, however, have recently taken up this article as a leader, which is a guarantee of the fact that the trade will become better acquainted with it.

The Ayers' windlass is probably the simplest and most durable windlass ever constructed, being built to stand the wear and tear of rough work. It is also sold at a price which is a good deal of an inducement, and a great many of them should be placed this Fall and Winter. The only safe method of suspending lamps is the windlass arrangement, which is a little more expensive on the start, but is the cheapest plan in the long run.

Star Soldering Stick.

The Western Electric Company is placing upon the market a soldering stick, the general appearance of which is shown in the accompanying illustration. The stick is about six inches long and seven-eighths of an inch in diameter. It is composed of carefully prepared and pure chemicals, which are non-corrosive, and at the same time make a very superior flux for soldering.

The virtue of this stick is that it makes the solder stick to the wire, and all well posted electricians understand how important it is that the solder should unite with the wire in making a joint. If there is a gap between the solder and the wire, and the two metals do not amalgamate, there is a local action caused by the current of electricity, which eventually will eat away the wire at the joint. It is for this reason that the underwriters have been so particular to specify that joints shall be well cleansed and soldered, knowing that a joint that is not cleansed could not be well soldered, and would be a hazard from the fire insurance standpoint.

THE STAR SOLDERING STICK.

The Packard Lamp in New York.

The New York & Ohio Company, of Warren, Ohio, the owners and manufacturers of the Packard incandescent lamp, have closed an arrangement with Schiff, Jordan & Company, of New York, to represent them hereafter in this territory. There will be carried at the new store of Schiff, Jordan & Company, 232–234 Greenwich street, a complete line of selected lamps so that customers can be promptly supplied. This is an electrical alliance that will surely result in mutual benefit to the parties interested.

LINCOLN PARK, CHICAGO.

One of the beauty spots of Chicago, is described in a most beautifully illustrated book, of 96 pages, now being distributed by the Chicago, Milwaukee & St. Paul Railway Company. It is full of the finest half-tone pictures of one of creation's most charming places of resort for citizens of the Great Republic. Every one who has ever visited the park will appreciate the souvenir, and, for those who have not, it will be a revelation of what is to be seen in Chicago. It can only be procured by inclosing twenty-five (25) cents in coin or postage stamps, to Geo. H. Heafford, general passenger agent, 410 Old Colony Building, Chicago, Ill.

TELEPHONE SERVICE
in New York City is Far-reaching,
covering forty square miles and 20,000 stations;
Efficient,
the service never stops night or day, and the speed of operating is high;
Economical,
the rates are strictly proportional to the subscriber's use and begin at $90 a year.
NEW YORK TELEPHONE CO.,
15 Dey St. 932 Broadway, 115 W. 38th St.

THIS CO HAS BEEN MAKING
TELEPHONES
20 YEARS, NOT CHEAP BUT SERVICEABLE AND FULLY GUARANTEED.
CIRCULARS FURNISHED.
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Incorporated,
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THE
HUDSON IRON COMPANY.
Manufacturing Site for Sale.....

85 ACRES OF LAND—1,100 FEET TIDE WATER FRONT, 400 FEET DOCKED. 2 SLIPS, EACH 250 FEET DEEP. TWO R. R. LINES.

The undersigned, permanent Receiver of the Hudson Iron Company, at Hudson, N. Y., offers for sale property as outlined above, in block or parcels to suit purchaser.

The docks are accessible to any vessel that can enter the harbor of New York.

Tracks of the N. Y. C. & H. R. R. R. and Boston & Albany R. R. run through the property.

Commodious office building and Fairbanks track scale of 50 tons capacity.

Shipping facilities by rail and water in all directions.

For manufacturing purposes, this property is unsurpassed by any on the Hudson River.

Shops of The Steel Tired Wheel Company, now in process of enlargement, adjoin the premises.

The Hudson Iron Company conducted business on this site for about 48 years, paying an average annual dividend of 12 per cent. The proceedings for its dissolution were voluntary, the company being entirely solvent, and the limit of its corporate life having been nearly reached.

FRANK H. STOTT,
Permanent Receiver Hudson Iron Co.
STOTTVILLE, N. Y.

J. RIDER CADY,
Counsel for Receiver,
10 So. Fourth St., Hudson, N. Y.

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WIRES AND CABLES FOR EVERY SERVICE.
For Underground, Aerial and Submarine use, "Safety" wires and cables have the indorsement of some of the largest users in the United States. Write for our booklet containing the experience of users.
THE SAFETY INSULATED WIRE & CABLE CO.,
225 to 239 West 28th Street, New York.
LEONARD F. REQUA, General Manager.

Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED OCTOBER 19, 1897.

591,855 Electrode for storage batteries; H. S. Lloyd, Philadelphia, Pa.—Comprises a frame, two or more layers or strips formed of lead or an alloy thereof, extending between the side bars of the frame, and a perforated leaden plate situated between such layers.

591,861 Electrical current interrupter; H. W. Mather, Roseville, N. J.—A strip of ribbon for an electrical current interrupter stencil, made of paper, having a portion of its fiber rendered structureless and forming a hard mass about the remaining fibers.

591,869 Electric transformer; W. S. Moody, Lynn, Mass.—A primary or high-potential winding surrounded by a heavy insulation which is separated from the winding by an air space or spaces, said insulation serving to insulate the primary from the secondary winding.

591,879 Electric controller; H. G. Reist, Schenectady, N. Y.—A controller for alternating-current induction motors, consisting of a single switch for opening and closing the primary circuit of the motor and for reversing the motor, and a separate regulating switch in the secondary circuit of the motor.

591,895 Electric push-button; E. H. Stanley, Lake Geneva, Wis.

591,897 Electro-magnetic engine; W. M. Storm, New York, N. Y.

591,898 Damper for electrical measuring instruments; E. Thomson, Swampscott, Mass.—A damping mechanism consisting of a moving member, a brake-piece, and a coil inducing an alternating magnetic field acting upon the brake-piece to alternately apply and release it.

591,899 Regulating Roentgen-ray tubes; E. Thomson, Swampscott, Mass.—A new article of manufacture, for use with Crookes tubes, having an extension containing a volatilizable substance or compound, a separable vacuum-adjuster consisting of an exhausted auxiliary bulb having a portion fitted to the main tube for the transfer of heat thereto, and containing terminals for the passage of electric discharges.

591,911 Electrically-operated railway gate; J. S. Biggar, Chicago, Ill.

591,917 Fuse-box; A. W. France, Philadelphia, Pa.

591,995 Electrical steering gear; J. D. Williamson, Jr., Philadelphia, Pa.

591,997 Insulated electric conductor and apparatus for making same; J. D. Bishop, New York, N. Y.

592,016 Insulating coupling for electric wire conduits; L. McCarthy, Boston, Mass.

592,056 Electrical traction; W. Kingsland, Llandudnc, England.

592,100 Automatic magnetic circuit-breaker; W. M. Scott, Philadelphia, Pa.

American Institute of Electrical Engineers.

The 119th meeting of the Institute will be held at 12 West Thirty-first street, New York city, on Wednesday, October 27, 1897, at 8 o'clock P. M.

A paper will be presented by Mr. Richard Lamb, of New York city, on "The Development of Electric Cableways."

OBITUARY.

Mr. George M. Pullman, president of Pullman's Palace Car Company, died suddenly at his home in Chicago early in the morning of October 19 from an affection of the heart. Mr. Pullman was in his 67th year, and died possessed of a fortune estimated at $50,000,000. He had many business interests, and was one of the directors of the Chicago Telephone Company.

STORAGE BATTERIES
THE WILLARD BATTERY CO. CLEVELAND, O.

AMERICAN STREET RAILWAY ASSOCIATION—Convention Notes.

(Concluded from page 207.)

ing was in an enthusiastic frame of mind by the time the flow of oratory was uncorked, and the applause was vociferous and frequent. The Hon. W. Caryl Ely presided with grace and tact. The toasts were: "The City of Niagara Falls," by Hon. Arthur C. Hastings, Mayor of the city; "The Association," by Mr. Smith B. Galt, of St. Louis. Mr. Galt has the genius of after-dinner speech-making, and his remarks were very much appreciated, both for their wit, pathos and application; "Wit and Humor of the Bar" was answered by Mr. Henry W. Box; Hon. Ashley W. Cole, "The Railroad Commissioners," and Mr. Henry H. Windsor spoke for the technical press.

Mr. W. J. Clark, the general manager of the railway department of the General Electric Company, maintained his well established reputation for hospitality.

The Walker company, of Cleveland, was represented by Mr. H. McL. Harding, manager of the New York office; Mr. Prof. S. H. Short, who was accompanied by his wife; Mr. F. W. Ferguson, the treasurer of the company, and Mr. Gay, of the Baltimore office. The Walker company had quite a large exhibit of generators, motors and street railway apparatus at the exhibition hall, and also maintained reception headquarters at the International Hotel. Their new controller and the largest street car motor in the world were features of their exhibit.

The Steel Motor Company, of Johnstown, Pa., had an exhibit, in charge of Mr. O. Dwight Henry, showing the Clark brake with 50-horse-power, 30-horse-power and 25-horse-power motors on Dupont truck. Mr. R. T. Lane, treasurer and secretary; Mr. J. M. Thomas and Mr. J. A. Rutherford, representing the company, were also present. Mr. Rutherford, who is one of the most widely informed men as to street railway matters, was at Niagara Falls during the entire session.

F. C. Randall, eastern representative of the Christensen Engineering Company, Milwaukee, aided Mr. Christensen in his well known convincing manner, explaining the workings of the firm's air-brakes.

George E. Fisher and O. D. Chase, of the Chase Engineering Company, Detroit, ran over from Buffalo to see what a big convention is like, and also place some orders for railway material.

Micanite products in greater variety than ever were exhibited in a handsome display presided over by Manager Coleman, of the Chicago office. It is no exaggeration to state that without micanite perfect insulation against high-pressure currents would be much harder.

Manager Shainwald, of the Standard Paint Company, Chicago, left all too early to satisfy a number of visitors who were anxious to obtain one of the handsomest souvenirs ever distributed at a convention. Especially those who are blessed with "better halfs" will have a hard time explaining why they came away without one of those exquisite ladies' pocketbooks.

"Of making of books there is no end," and some are read while others soon sink into oblivion. The booklet distributed by the Sargent company, Chicago, will be read with much interest by all railway officials who are still in doubt as to what is the best brake-shoe.

The Standard Air-Brake Company had a striking exhibit, eclipsing those of former years. It showed the great progress which that energetic company had made. The Standard Air-Brake Company is said to be the first concern in the world to build street railway air-brakes, and its exhibit practically illustrated the different types of apparatus manufactured, from the beginning of its business to date. It occupied a prominent space between the General Electric and Brill companies. The apparatus was in charge of the company's managing director, Mr. E. J. Wessels, who was assisted by the chief engineer, E. H. Dewson, Jr. The company was also represented by Messrs. George E. Pratt and C. B. Fairchild, special agents; H. H. Taylor, assistant engineer, and E. E. Robinson, foreman. A Brill No. 27 truck is equipped with the well known duplex compressor, direct axle driven. Thirty are completing their third year of active service on the Buffalo Railway Company's road. The geared compressor, which is the standard on several roads in the United States and Canada, was also shown. This type has proved admirably suited for heavy traction and high speeds. Back of the duplex was shown the Standard company's hollow spindle brake-cylinder, with fulcrum on back head for equalizing double-truck brake rigging. A handy attachment enabled delegates to see how quickly and easily pressure can be applied. The attachment embraced a graduated spring, with a pressure indicator which showed the range from minimum to maximum, the latter being equal to an emergency stop.

McINTIRE'S PATENT
CONNECTORS AND TERMINALS.
Special Connectors for HARD-DRAWN COPPER WIRE, *All Sizes.*
Fused Wire, Fused Links and Strips.
The C. McINTIRE CO., 13 & 15 Franklin Street, Newark, N. J.

Mr. Kellogg's Telephone Switchboard Patents.

On Tuesday of this week the United States granted 125 patents to Mr. Milo G. Kellogg, the well known electrical inventor, of Chicago. These patents all relate to switchboards for telephone exchanges, and are assigned to the Kellogg Switchboard and Supply Company, of Chicago. They comprise the largest number of patents ever issued to one inventor at one time, and the Patent Office *Gazette* for this week consists of 288 pages, and is the largest ever issued. Prior to this date its largest issue consisted of 194 pages. The check covering the final fees for these patents was the largest ever paid into the Patent Office at one time. Messrs. Baldwin, Davidson & Wight, of New York and Washington, were the patent attorneys.

The issuance of these patents will undoubtedly create a sensation in the telephone field, as it is understood that they cover the most modern telephone switchboard practice, and, while founded on the multiple system, are entirely independent of all former switchboard patents.

TREASURY DEPARTMENT, WASHINGTON, D. C., October 23, 1897.—Sealed proposals will be received at this Department until 2 o'clock P. M., November 30, 1897, for installing an electric light and power plant in the Post Office Building, Washington, D. C. Proposals will be received as follows: 1. For tubing and wiring the building. 2. For dynamos and engines. 3. For the plant complete. Proposals must be accompanied by certified checks, drawn to the order of the Treasurer United States, as a guarantee of good faith. The amount of the checks, together with other requirements relating thereto, is fully set forth in the specifications of the Department. The right to reject any and all bids, and to waive defective bids, is reserved by the Department. Specifications and plans can be obtained upon application to the Chief Clerk, Treasury Department. Proposals should be addressed to the Secretary of the Treasury, and indorsed: "Proposals for Electric Light and Power Plant, Post Office Building, Washington, D. C." O. L. Spaulding, assistant secretary.

PERSONAL.

Mr. George C. Maynard, the well known electrical engineer, of Washington, D. C., visited New York city last week.

Mr. J. W. Kempster, of England, representing the Queen's Engineering Works at Bedford, is visiting this country. Mr. Kempster is a nephew of Mr. James Kempster, the well known printer and publisher, and is visiting this country with a view of investigating the latest developments in the electrical and mechanical fields. Before returning he will visit all our large electrical factories, and we bespeak for him a cordial welcome.

Mr. E. G. Long, of the Peckham Truck Company, was a passenger on the ill-fated train from Niagara Falls that ran into the Hudson River Sunday morning last, near Garrisons, N. Y. He made his escape from the window, passing out as the water rushed in. Dr. W. M. Habirshaw, another well known electrical gentleman, had intended to take this train, but was on the one immediately behind it and escaped injury. His baggage, however, which was on the first train, went to the bottom of the river, and at last accounts was still there.

A New Telephone Catalogue.

The Standard Telephone and Electric Company, of Madison, Wis., has sent out a very complete and well prepared catalogue of its line of telephone apparatus and supplies. This company uses the Mildé transmitter on its telephones, and considerable space in the new catalogue is devoted to a thorough description of this device. The Standard Telephone and Electric Company's line of telephone apparatus is especially complete, and designed for every possible service. The company is to be congratulated on the appearance of its new catalogue, which is sent free on request.

Suit Over Electric Cable Patents.

The Standard Underground Cable Company, of Pittsburgh, has entered suit against the National Conduit and Cable Company, of New York, for infringement of a number of its patents on cables, terminals, T joints, etc. The suit was begun in the United States Circuit Court, Southern District of New York, and the patents involved are five in number as follows: Nos. 242,894, 388,477, 371,808, 395,546 and 574,343.

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PATENTS.
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CAN YOU OBTAIN A PATENT?
Send me a model or drawing of your invention, and a description, and I will examine same and advise you promptly. My fees are moderate in all Patent matters, and I can obtain a Patent in the shortest possible time.
All patents taken out through me are given special notice in the leading journals of the country, thus bringing same widely before the public without cost to inventor.
REFERENCES: "Electrical Review," New York; Paul Cromlein, Teller Lincoln National Bank, Washington, D. C.; Judge Geo. D. Parker, Berkley, Va.; Second National Bank, Washington, D. C.; E. K. Leech, U. S. Mint, Philadelphia, Pa.; W. F. Newell, Manager and Secretary Water Works, Olympia, Oregon.
EDW. S. DUVALL, Solicitor of Patents. Loan and Trust Bldg., WASHINGTON, D. C.